NCERT

CHAPTER WISE

TOPIC WISE

LINE BY LINE QUESTIONS

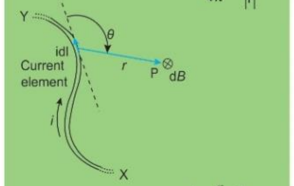
2024

BY SCHOOL OF EDUCATORS

MOVING CHARGES AND MAGNETISM

BIOT – SAVART'S LAW

The Biot – Savart law gives the Relationship of magnetic field at any point with current Carrying element. $dB = \frac{\mu_0}{4\pi}\int\frac{\vec{d\ell}\times\vec{r}}{|r|^3}$

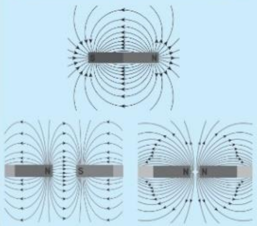


In vector form : $\vec{B} = \frac{\mu_0 i}{4\pi}\int\frac{d\vec{l}\times\vec{r}}{|r|^3}$

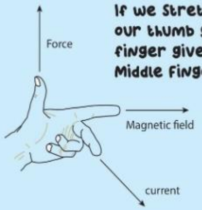
MAGNETIC FIELD

The Region around a magnet in which its magnetic influence can be experienced is called magnetic field. ($\vec{B}$)

- S.I unit Tesla (T).
- Denote Coming out.
- Denote going into the paper.

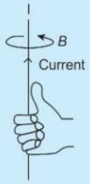


FLEMING'S LEFT-HAND RULE



If we stretch our finger's like image, then our thumb gives direction force. Index finger gives direction of Magnetic field & Middle finger gives current.

RIGHT-HAND RULE

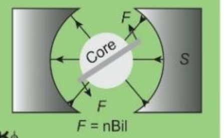


Holding a currant carrying conductor in right hand in such a way that thumb points in the direction of current and curling finger's gives direction of magnetic field.

MOVING COIL GALVANOMETER

It works on the principle that a current carrying Coil in uniform magnetic field, experience a Torque.

- Torque - τ = nBiA
  - n = Number of coils
  - A = Area
- Restoring Torque = $\tau = K\phi$
  - ϕ = Deflection
- In Equillibrium = τ = nBiA = $K\phi$
  - $\rightarrow i = \frac{K}{nBA}\phi$



Current Sensitivity : $S_i = \frac{\phi}{i} = \frac{nBA}{K}$

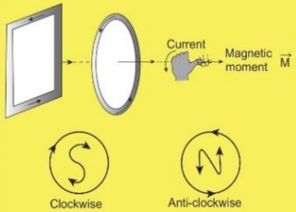
Voltage Sensitivity : $S_v = \frac{\phi}{i} = \frac{Si}{R} = \frac{nBA}{KR}$

CURRENT CARRYING LOOP AS MAGNETIC DIPOLE

The Current Carrying Coil behaves as a bar magnet and magnetic moment of such Coil Can be expressed as M = niA .

n = Number of Coils

A = Area

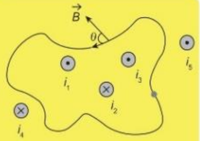


Direction of current in Coil Show's Polarity

AMPERE'S CIRCUITAL LAW

This Law States that the line integral of magnetic field $\vec{B}$ around a closed loop is equal to μ_0 times the net current enclosed by the loop.

$\oint\vec{B}.\vec{dl} = \mu_0\sum i_{enclosed}$



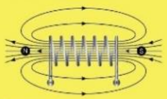
MAGNETIC FIELD OF TOROID :

B = $\mu_0$ni : Here, n = $\frac{N}{2\pi r}$

r = average radius

N = Total number of turns in toroid.

MAGNETIC FIELD OF LONG SOLENOID :

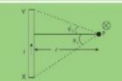
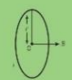
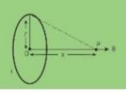


B = $\mu_0$ni

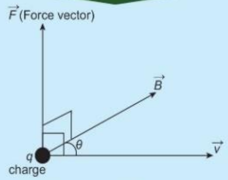
N = Number of turn's per unit length.

i = Current flowing

MAGNETIC FIELD OF SOME SPECIAL CURRENT CARRYING CONDUCTORS

Shape of current carrying conductor	Formula	Special case
	$\vec{B} = \frac{\mu_0 i}{4\pi}(Sin\phi_1 + Sin\phi_2)\hat{\eta}$	For infinitely long conductor.
	$\vec{B} = \frac{\mu_0 i}{2\pi}(\frac{\theta}{360_0})\hat{\eta}$	For semicircular arc.
	$\vec{B} = \frac{\mu_0 i}{2\pi}\hat{\eta}$	r = radius of Coil.
	$\vec{B} = \frac{\mu_0 i r^2}{2(x^2+r^2)^{3/2}}$	X = distance from the center of coil.

MAGNETIC FORCE ON A MOVING CHARGED PARTICLE



$\vec{F} = q(\vec{V}\times\vec{B})$, $|\vec{F}| = qVBSin\theta$

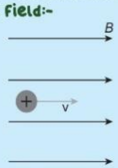
θ = Angle between direction of motion of charge and magnetic field.

- Power delivered by Magnetic force to Charged Particle is always zero.

$P = \vec{F}.\vec{V} = \upsilon[\because(\vec{F}\perp\vec{V})$

Path of charged particle in External Magnetic field:-

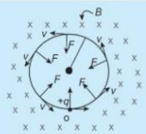
Case 1:



when charged particle is moving parallel or antiparallel to magnetic field: Magnetic force F = qvB Sinθ = 0

Charge particle move un - deviated Radius of Path is r = ∞

Case 2:



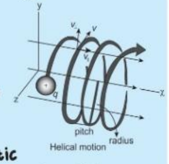
when charge Particle moving Perpendicular to magnetic field:- Magnetic force – F = qvB Sin90° = qvB

$\therefore\frac{mv^2}{r} = qvB \Rightarrow r = \frac{mV}{qB}$

∴ Radius of circular- Path $r = \frac{mV}{qB}$

Time Period – T = $\frac{2\pi m}{qB}$

Case 3:



when charge Particle is moving in any orbitary direction with respect to Magnetic field:- Magnetic force F = $q(\vec{V}\times\vec{B})$ = qvB sinθ

Charge Particle follow Helical Path.

Radius of Helix – r = $\frac{mV Sin\theta}{qB} = \frac{mV_\perp}{qB}$

Time Period – T = $\frac{2\pi}{qB}$

Bohr Magneton

The magnetic moment associated with an electron which is revolving in first orbit of an atom.

It is represented as:-

$\mu_B = \frac{eh}{4\pi m} = 0.923\times10^{-23}\ Am^2$

e = electronic charge

m = mass of electron

h = Planck & Constant

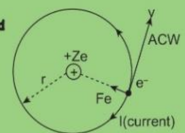
ATOMIC MAGNETISM

when an electron revolves, due to its movement it behaves as a current carrying loop and Produce magnetic field. This is Known as Atomic Magnetism.

Orbital Current

The orbital Current generated by electron revolving around nucleus $-I = \frac{e\omega}{2\pi}$

ω is angular velocity of electron.



Magnetic Induction at Nucleus Position

$B = \frac{\mu_0 I}{2r} = \frac{\mu_0 ew}{4\pi r}$

r = orbital Radius, I = orbital current

Magnetic Moment circular orbit

$M = IA = \frac{ewr^2}{2} = \frac{evr}{2}$ A= Area of orbit.

Relation Between Magnetic Moment and Angular Momentum of Charge Particle

$M = \frac{qL}{2m} \Rightarrow \frac{M}{L} = \frac{q}{2m}$

where, M = Magnetic Moment

L = mvr – Angular Momentum

m = mass of particle.

Torque Acting on current Carrying Coil:	work done in Rotating a coil Placed in magnetic field:	Potential Energy of a Coil Placed in Magnetic Field:
τ = nBiA Sinθ N = Number of turns A= Area I = current Magnetic moment – $\vec{M} = i\vec{A}$ $\therefore\vec{\tau} = \vec{M}\times\vec{B}$	W = MB (1 – Cosθ) Here, M = Magnetic Moment of coil.	U = – MB Cosθ $= -\vec{M}.\vec{B}$

MAGNETIC EFFECT OF CURRENT

Force on current carrying conductor in magnetic field

In uniform Magnetic field the total force acting on conductor of Length L is expressed as.

$\vec{F} = i(\vec{L}\times\vec{B}) = iLBSin\theta$

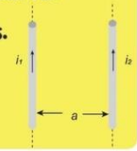
θ = Angle made by current direction with magnetic field.

Force between two Parallel Current Carrying Conductor' s

$F_1 = F_2 = F = \frac{\mu_0 i_1 i_2}{2\pi a}\times L$

a = distance between two wires.

L = Length of wires.



NCERT LINE BY LINE QUESTIONS

1. A current element $\Delta l = dx\hat{i}$ (where *dx* = 1 cm) is placed at the origin and carries a large current of 10 A. The magnetic field on y-axis at distance of 50 cm from it is

(a) 2×10^{-8}T (b) 2×10^{-5}G (c) 4×10^{-8}T (d) 3×10^{-5}G

2. Consider a tightly wound 100 turn coil of radius 12 cm carrying current of 10 A. What is magnetic field at centre of this coil.

(a) 1.2×10^{-3}T (b) 5.2×10^{-3}T (c) 4.6×10^{-5}T (d) 1.9×10^{-6}T

3. A straight wire carrying current of **15** A is bent into a semicircular arc of radius **2.5** cm. The magnetic field at the centre of semicircular arc is

(a) 1.88×10^{-4}T (b) 2.6×10^{-4}T (c) 3.77×10^{-4}T (d) 5.2×10^{-4}T

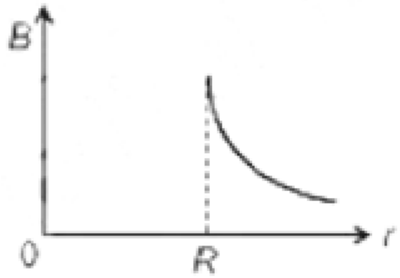
4. Consider a tightly wound 200 turns coil of radius 10 cm carrying current of 10 A. The magnitude of magnetic field at the centre of the coil is

(a) $2\pi\times10^{-4}$T (b) $4\pi\times10^{-3}$T (c) $6\pi\times10^{-4}$T (d) $3\pi\times10^{-3}$T

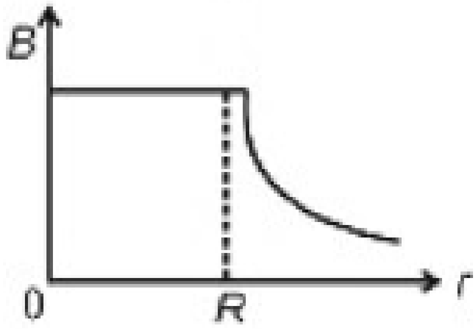
5. A long straight wire of circular cross-section of radius 5 cm is carrying a steady current of 20 A, uniformly distributed over its cross-section. The magnetic field induction at 2 cm from the axis of the wire is

(a) 1.6×10^{-4}T (b) 2.8×10^{-2}T (c) 3.3×10^{-6}T (d) 3.2×10^{-5}T

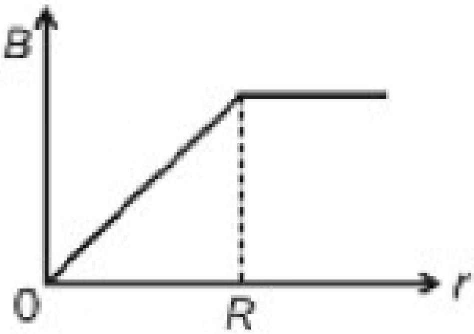
6. A long straight cylindrical wire carries current I and current is uniformly distributed across cross-section of conductor. Figures below shows a plot of magnitude of magnetic field with distance from centre of the wire. The correct graph is



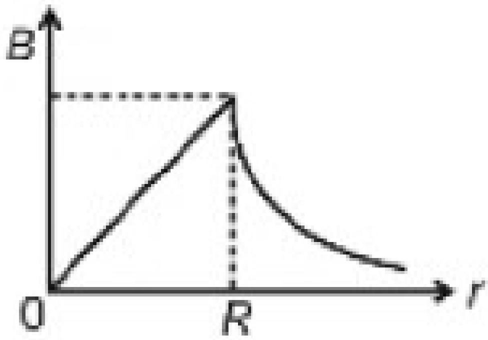
(a)



(b)



(c)



(d)

7. A closely wound solenoid 80 cm long has 5 layers of winding of 400 turns each. The diameter of solenoid is 1.8 cm. If it carries current of 8 A then magnitude of magnetic field intensity inside solenoid near its centre is

(a) 1.62×10^{-4}T (b) 25.13×10^{-3}T (c) 3.1×10^{-2}T (d) 16.8×10^{-3}T

8. A circular coil of 30 turns and radius 8 cm carries a current of 6 A. It is suspended in a uniform horizontal magnetic field of 1.0 T. The field lines make an angle of 60° with the normal of the coil. The magnitude of counter torque that must be applied to prevent the coil from turning is

(a) 3.133 Nm (b) 0.236 N m (c) 30.8 N m (d) 35 N m

9. In a chamber, a uniform magnetic field of 1.2 T is maintained. An electron is shot into the field with a speed of 3.2 X 10^{6} m s^{-1} normal to the field. The radius of circular orbit in which it starts circular path is (m_0 = 9.1 X 10^{-31} kg)

(a) 15.16 μm (b) 627 μm (c) 12.42 μm (d) 22.4 μm

10. Two moving coil galvanometers M_1 and M_2 have the following particulars. N_1 = 30, B_1= 0.25 T, A_1 = 7.2 X 10^{-3} m^2, G_1 = 10Ω and N_2 = 60, B_2 = 0.50 T, A_2 = 1.8 X 10^{-3} m^2, G_2 = 5Ω respectively. The spring constants are identical to both galvanometers. The ratio of their current sensitivity is

(a) 1:1 (b) 2:1 (c) 4 : 1 (d)1:4

11. A toroid ring has inner radius 21 cm and outer radius 23 cm in which 4400 turns of wire are wound. If the current in the wire is 10 A, then magnetic field inside the core of the toroid will be

(a) 4.4×10^{-4}T (b) 4×10^{-2}T (c) 6.6×10^{-4}T (d) 12.6×10^{-3}T

12. Two concentric circular coils X and Y of radius 20 cm and 25 cm respectively lie in the same vertical plane. Coil X has 40 turns and coil Y has 100 turns. If coil X and Y carries currents of 18 A each but in opposite
sense, the net magnetic field due to the coils at their centre is

(a) 3.12×10^{-4}T (b) 1.2×10^{-5}T (c) 7.2×10^{-4}T (d) 2.26×10^{-3}T

13. A galvanometer has resistance of 60Ω. It is converted in to an ammeter by connecting a shunt resistance of 1.2Ω . Its range becomes

(a) 68 (b) 50 (c) 51 (d) 60

14. To convert a galvanometer into a voltmeter of large range, we connect a resistance with galvanometer. The resistance

(a) Is connected in parallel and of higher value

(b) Is connected in series and of lower value

(c) Is connected in parallel and of lower value

(d) Is connected in series and of higher value

15. Magnetic moment associated with an electron moving at speed v in a circular orbit of radius r is (in magnitudes)

(a) evr (b) $\frac{evr}{2}$ (c) $\frac{evr}{4}$ (d) $\frac{ev^2}{2r}$

16. The horizontal component of earth's magnetic field at a certain place is 3.2 x 10^{-5} T and field is directed from south to North. A long straight conductor is carrying a current of 3 A. What is force per unit length experienced by it when it is placed on horizontal table and current in wire is from west to east?

(a) 9.6 X 10^{-6} Nm^{-1} upwards (b) 9.6 X 10^{-5} Nm^{-1}. downwards
(c) 3.6 X 10^{-5} Nm^{-1}, upwards (d) 9.6 X 10^{-5} Nm^{-1}, horizontal

17. Two long straight parallel wires A and B carrying current of 20 A and 10 A is same direction are separated by a distance of 5 cm. The force of 15 cm section of wire B is

(a) 1.5×10^{-3}N , attractive (b) 1.6×10^{-4}N , repulsive
(c) 1.2×10^{-3}N, attractive (d) 1.2×10^{-4}N, attractive

18. A cyclotron's oscillatory frequency is 10 MHz. What should be the operating magnetic field for accelerating deuterons?

(a) 0.96 T (b) 1.52 T (c) 0.46 T (d) 1.32 T

19. A charge $q = 1.6\times10^{-12}$ C moving with speed of v m s^{-1} crosses electric field $|\vec{E}| = 6\times10^4$ Vm^{-1} and magnetic field $|\vec{B}| = 1.2T$. The electric field and magnetic fields are crossed and velocity v is also perpendicular to both. If the charge particle crosses both fields undeflected, the value of v is

(a) 7.2×10^5 (b) 7.2×10^4 (c) 5×10^5 (d) 5×10^4

20. A proton is moving with speed of 2 x 10^5 m s^{-1} enters a uniform magnetic field B = 1.5 T. At the entry velocity vector makes an angle of 30° to the direction of the magnetic field. The pitch of helical path it
describes is nearly

(a) 6.25 mm (b) 4.37 mm (c) 7.25 mm (d) 1.67 mm

NCERT BASED PRACTICE QUESTIONS

1. A magnetic field line is used to find the direction of

(a) south – north (b) a bar magnet
(c) a compass needle (d) magnetic field

2. An electric current passes through a straight wire in the direction of south to north. Magnetic compasses are placed at points A and B as shown in the figure.

What is your observation?
(a) the needle will not deflect
(b) only one of the needles will deflect

(c) both the needles will deflect in the same direction
(d) the needles will deflect in the opposite directions

3. The magnetic field lines due to a straight wire carrying a current are
(a) straight (b) circular
(c) parabolic (d) elliptical

4. Magnetic field produced at the centre of a current carrying circular wire is
(a) directly proportional to the square of the radius of the circular wire
(b) directly proportional to the radius of the circular wire
(c) inversely proportional to the square of the radius of the circular wire
(d) inversely proportional to the radius of the circular wire

5. The magnetic field lines inside a long, current carrying solenoid are nearly
(a) straight (b) circular
(c) parabolic (d) elliptical

6.‘ A soft iron bar is introduced inside a current carrying solenoid. The magnetic field inside the solenoid
(a) will become zero (b) will decrease
(c) will increase (d) will remain unaffected

7. The direction of the force on a current-carrying wire placed in a magnetic field depends on
(a) the direction of the current
(b) the direction of the field
(c) the direction of current as well as field
(d) neither the direction of current nor the direction of field

8. The direction of induced curent is obtained by
(a) Fleming's left-hand rule
(b) Maxwell's right-hand thumb rule
(c) Ampere's rule
(d) Fleming's right-hand rule

9. Who first discovered the relationship between electricity and magnetism?
(a) Faraday (b) Newton
(c) Maxwell (d) Oersted

10.: In an electric motor, the energy transformation is from
(a) electrical chemical (b) chemical to light
(c) mechanical to electrical (d) electrical to mechanical

11. A commentator changes the direction of current in the coil of
(a) a DC motor
(b) a DC motor and an AC generator
(c) a DC motor and a DC generator
(d) an AC generator

12. ____Which of the following devices works on the principle of electromagnetic induction?
(a) Ammeter (b) Voltmeter
(c) Generator (d) Galvanometer

13. __A device used for measuring small currents due to changing magnetic field is known as
    (a) galvanometer (b) ammeter
    (c) voltmeter (d) potentiometer
14.: An electric generator actually acts as
    (a) source of electric charge (b) source of heat energy
    (c) an electromagnet (d) a converter of energy
15. Electromagnetic induction is the
    (a) charging of a body with a positive charge
    (b) production of a current by relative motion between a magnet and a coil
    (c) rotation of the coil of an electric motor
    (d) generation of magnetic field due to a current carrying solenoid
16. For making a strong electromagnet, the material of the core should be
    (a) soft iron (b) steel
    (c) brass (d) copper
17. Magnetic field inside a long solenoid carrying current is
    (a) same at all points (uniform)
    (b) different at poles and at the centre
    (c) zero
    (d) different at all points
18. You have a coil and a bar magnet. You can produce an electric current by
    1. moving the magnet but not the coil
    2. moving the coil but not the magnet
    3. moving either the magnet or the coil
    4. using another DC source
19.: A fuse in an electric circuit acts as a
    1. current multiplication
    2. voltage multiplication
    3. power multiplier
    4. safety device
20. The magnetic lines of force inside a current carrying solenoid are
    1. along the axis and parallel to each other
    2. perpendicular to the axis and parallel to each other
    3. circular and do not intersect each other
    4. circular and intersect each other
21. Who was the first person to notice the magnetic effect of electric current?
    (a) Faraday (b) Ampere (c) Oersted (d) Volta
22. The magnetic field produced due to the current passing through a conductor is proportional to the
    (a) electric current (b) conducting material
    (c) length of conductor (d) diameter of conductor
23. 'The magnetic field produced at the center of a circular wire is proportional to and inversely proportional to
    (a) radius of loop, current (b) current, radius of loop
    (c) length of conductor, current (d) weight of conductor, current

24. The magnetic field of a solenoid is quite similar to that of
(a) a straight conductor (b) a horse-shoe magnet
(c) a bar magnet (d) any magnet

25. The principle of magnetic induction was given by
(a) Michael Faraday (b) Galileo
(c) Oersted (d) Ampere

26. The direction of a magnetic field is taken
(a) north to south and back (b) south to north and back
(c) north to south only (d) south to north only

27. In our domestic electric supply we use following three colours of wire.
(a) red, blue, green (b) red, yellow, blue
(c) red, black, green (d) black, green, yellow

28. The magnetic field due to electric current in a conductor is
(a) in the direction of electric current
(b) in the direction opposite to electric current
(c) circular around the conductor
(d) in the center of the conductor

29. Which device is used to convert electric energy into mechanical energy ?
(a) electric generator (b) solenoid
(c) electric motor (d) electric iron

30. The principle of electric generator is
(a) conversion of electrical energy into mechanical energy
(b) conversion of electrical energy into thermal energy
(c) conversion of mechanical energy into electrical energy
(d) conversion of electrical energy into light energy

31. Magnetic lines of force inside a solenoid are...
(a) from N to S (b) from S to N
(c) circular (d) Qintersect one another

32. A magnetized wire of magnetic moment M and length L is bent in the form of a semicircle of radius 'r'. The new magnetic moment is
(a) M (b) $M/2\pi$ (c) M/π (d) $2M/\pi$

33 In a hydrogen atom the electron is making 6.6×10^{15} revolutions per second around the nucleus in an orbit of radius 0.528 Å. The equivalent magnetic dipole moment is approximately (in Am^2)
(a) 10^{-10} (b) 10^{-15} (c) 10^{-2} (d) 10^{-25}

34. Two short magnets of dipole moments M and 2M are arranged on the table so that the axial line of the weaker magnet and the equatorial line of the stronger magnet are coinciding. If the separation between the magnets is 2d, what is the magnetic flux density midway between these magnets? Ignore the earth's magnetic field.
(a) $\mu_0 M/4\pi d^3$ (b) $3\mu_0 M/4\pi d^3$ (c) $(\mu_0 M/4\pi d^3)\sqrt{3}$ (d) $(\mu_0 M/4\pi d^3)\sqrt{3}$

35. An electron and a proton with the same momentum enter perpendicularly into a uniform magnetic field

a. Both particles will deflect equally,

b. The proton will deflect more than the electron,

c. The electron will deflect less than the proton

d. None

36. Two parallel beams of electrons moving in the same direction will

a. Repel each other,

b. Attract each other,

c. Neither attract nor repel each other.

d. none

37. When an electron moves in a magnetic field 'B' with velocity 'V' the force acting on it is perpendicular to

a .V but not to B, b. both V and B,

c. B but not V d. none

38. If an electron and proton enter into a magnetic field with the same velocity, the electron shall experience a/an force than the proton.

a. Greater, b. Lesser,

c. Equal d. none

39. Magnetism derives its name from a region in Asia Minor (Modern Turkey) where it was found in for form of certain iron core.

a. Magnesia b. Magnesium,

c. Electromagnetism d. None of these

40 . If a magnet is broken into two pieces, then

a. Two magnets are obtained,

b. North pole is obtained,

c. South pole is obtained,

d. One north pole and one south pole is obtained

41. A magnet can be demagnetized by

a. Heating,

b. By dropping it several time,

c. breaking into two pieces,

d. both heating and by dropping it several time

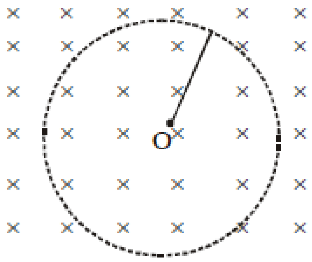
TOPIC WISE PRACTICE QUESTIONS

Topic 1: Motion of Charged Particle in Magnetic Field

1. A particle of mass *m* and charge *q* enters a magnetic field *B* perpendicularly with a velocity *v*. The radius of the circular path described by it will be

(1) Bq/mv (2) mq/Bv (3) mB/qv (4) mv/Bq

2. The figure shows a thin metalic rod whose one end is pivoted at point O. The rod rotates about the end O in a plane perpendicular to the uniform magnetic field with angular frequency w in clockwise direction. Which of the following is correct?



(1) The free electrons of the rod move towards the outer end.
(2) The free electrons of the rod move towards the pivoted end.
(3) The free electrons of the rod move towards the mid-point of the rod.
(4) The free electrons of the rod do not move towards any end of the rod as rotation of rod has no effect on motion of free electrons.

3. A charged particle enters into a magnetic field with a velocity vector making an angle of 30° with respect to the direction of magnetic field. The path of the particle is

(1) circular (2) helical (3) elliptical (4) straight line

4. A particle is projected in a plane perpendicular to a uniform magnetic field. The area bounded by the path described by the particle is proportional to

(1) the velocity (2) the momentum (3) the kinetic energy (4) None of these

5. An electric charge +*q* moves with velocity $\vec{v} = 3\hat{i} + 4\hat{j} + \hat{k}$ in an electromagnetic field given by $\vec{E} = 3\hat{i} + \hat{j} + 2\hat{k}$ and $\vec{B} = \hat{i} + \hat{j} - 3\hat{k}$ .The *y*-component of the force experienced by + *q* is :

(1) 11 *q* (2) 5 *q* (3) 3 *q* (4) 2 *q*

6. A straight steel wire of length *l* has a magnetic moment M. When it is bent in the form of a semi-circle its magnetic moment will be

(1) M (2) M/π (3) 2 M/π (4) Mπ

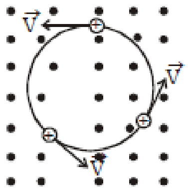
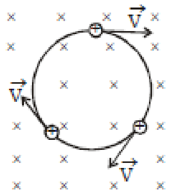
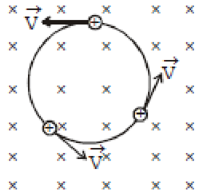
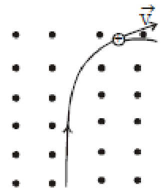
7. The magnetic force acting on a charged particle of charge – 2 μ C in a magnetic field of 2T acting in y direction, when the particle velocity is $\left(2\hat{i} + 3\hat{j}\right) \times 10^6 ms^{-1}$, is

(1) 4 N in z direction (2) 8 N in y direction (3) 8 N in z direction (4) 8 N in – z direction

8. A charged particle goes undeflected in a region containing electric and magnetic fields. It is possible that

(1) $\vec{E} \parallel \vec{B}, \vec{v} \parallel \vec{E}$
(2) $\vec{E}$ is not parallel to $\vec{B}$
(3) $\vec{v} \parallel \vec{B}$ but $\vec{E}$ is not parallel to $\vec{B}$
(4) $\vec{E} \parallel \vec{B}$ but $\vec{v}$ is not parallel to $\vec{E}$

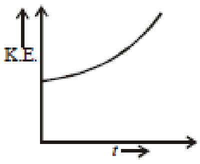
9. A positively charged particle enters in a uniform magnetic field with velocity perpendicular to the magnetic field. Which of the following figures shows the correct motion of charged particle?

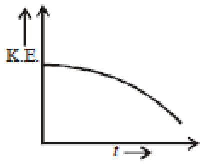
(1)  (2)  (3)  (4) 

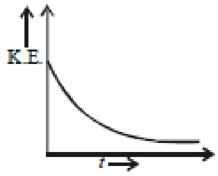
10. A thin circular wire carrying a current I has a magnetic moment M. The shape of the wire is changed to a square and it carries the same current. It will have a magnetic moment

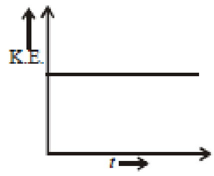
(1) M (2) $\frac{4}{\pi^2}M$ (3) $\frac{4}{\pi}M$ (4) $\frac{\pi}{4}M$

11. A charged particle enters in a magnetic field in a direction perpendicular to the magnetic field. Which of the following graphs show the correct variation of kinetic energy of the particle with time t?

(1) 

(2) 

(3) 

(4) 

12. An electron moves in a circular orbit with a uniform speed v. It produces a magnetic field B at the centre of the circle. The radius of the circle is proportional to

(1) $\sqrt{\frac{B}{v}}$ (2) $\frac{B}{v}$ (3) $\sqrt{\frac{v}{B}}$ (4) $\frac{v}{B}$

13. A proton moving with a velocity 3×10^5 m/s enters a magnetic field of 0.3 tesla at an angle of 30º with the field. The radius of curvature of its path will be (e/m for proton = 10^8 C/kg)

(1) 2 cm (2) 0.5 cm (3) 0.02 cm (4) 1.25 cm

14. A beam of electrons is moving with constant velocity in a region having simultaneous perpendicular electric and magnetic fields of strength 20 Vm^{-1} and 0.5 T respectively at right angles to the direction of motion of the electrons. Then the velocity of electrons must be

(1) 8 m/s (2) 20 m/s (3) 40 m/s (4) 1/40m/ s

15. A uniform magnetic field acts at right angles to the direction of motion of electron. As a result, the electron moves in a circular path of radius 2cm. If the speed of electron is doubled, then the radius of the circular path will be

(1) 2.0 cm (2) 0.5 cm (3) 4.0 cm (4) 1.0 cm

16. A proton moving with a constant velocity passes through a region of space without any change in its velocity. If E and B represent the electric and magnetic fields respectively, this region of space may not have

(1) E = 0, B = 0 (2) E = 0, B $\neq$ 0 (3) E $\neq$ 0, B = 0 (4) E $\neq$ 0, B $\neq$ 0

17. A charged particle (charge q) is moving in a circle of radius R with uniform speed v. The associated magnetic moment m is given by

(1) qvR^2 (2) $qvR^2/2$ (3) qvR (4) qvR/2

18. A charged particle moves with velocity $\vec{v} = a\hat{i} + d\hat{j}$ in a magnetic field $\vec{B} = A\hat{i} + D\hat{j}$. The force acting on the particle has magnitude F. Then,

(1) F = 0, if aD = dA

(2) F = 0, if aD = –dA

(3) F = 0, i f aA = – dD

(4) $F \propto (a^2 + b^2)^{1/2} \times (A^2 + D^2)^{1/2}$

19. If a particle of charge 10^{-12} coulomb moving along the $\hat{x}$ - direction with a velocity 10^5 m/s experiences a force of 10^{-10} newton in $\hat{y}$ - direction due to magnetic field, then the minimum magnetic field is

(1) 6.25×10^3 Tesla in $\hat{z}$ - direction

(2) 10^{-15} Tesla in $\hat{z}$ - direction

(3) 6.25×10^{-3} Tesla in $\hat{z}$ - direction

(4) 10^{-3} Tesla in $\hat{z}$ - direction

20. A certain region has an electric field $\vec{E} = \left(2\hat{i} - 3\hat{j}\right) N/C$ and a uniform magnetic field $B = \left(5\hat{i} + 2\hat{j} + 4k\right)T$. The force experienced by a charge 1C moving with velocity $\left(\hat{i} + 2\hat{j}\right)$ ms^{-1} is

(1) $\left(10\hat{i} - 7\hat{j} - 7\hat{k}\right)$ (2) $\left(10\hat{i} + 7\hat{j} + 7\hat{k}\right)$ (3) $\left(-10\hat{i} + 7\hat{j} + 7\hat{k}\right)$ (4) $\left(10\hat{i} + 7\hat{j} - 7\hat{k}\right)$

21. A cathode ray beam is bent in a circle of radius 2 cm by a magnetic induction 4.5×10^{-3} weber/m^2. The velocity of electron is

(1) 3.43×10^7 m/s (2) 5.37×10^7 m/s (3) 1.23×10^7 m/s (4) 1.58×10^7 m/s

22. A proton and an a-particle enter a uniform magnetic field perpendicularly with the same speed. If proton takes 25μ second to make 5 revolutions, then the time period for the $\alpha -$particle would be

(1) 50 μsec (2) 25 μsec (3) 10 μsec (4) 5 μsec

23. A wire of length L metre carrying a current I ampere is bent in the form of a circle. Its magnitude of magnetic moment will be

(1) IL/4π (2) $I^2L^2/4\pi$ (3) $IL^2/4\pi$ (4) $IL^2/8\pi$

24. What is cyclotron frequency of an electron with an energy of 100 e V in the magnetic field of 1×10^{-4} weber / m^2 if its velocity is perpendicular to magnetic field?

(1) 0.7 MHz (2) 2.8 MHz (3) 1.4 MHz (4) 2.1 MHz

25. A charged particle with velocity 2×10^3 m/s passes undeflected through electric and magnetic field. Magnetic field is 1.5 tesla. The electric field intensity would be

(1) 2×10^3 N/C (2) 1.5×10^3 N/C (3) 3×10^3 N/C (4) $4/3 \times 10^{-3}$ N/C

26. An electron moving with kinetic energy 6×10^{-16} joules enters a field of magnetic induction 6×10^{-3} weber/m^2 at right angle to its motion. The radius of its path is

(1) 3.42 cm (2) 4.23 cm (3) 5.17 cm (4) 7.7 cm

Topic 2: Magnetic Field Lines, Biot-Savart's Law and Ampere's Circuital Law

27. A current I flows along the length of an infinitely long, straight, thin walled pipe. Then

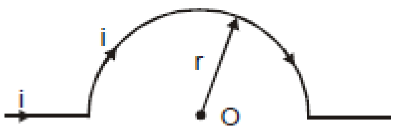
(1) the magnetic field at all points inside the pipe is the same, but not zero

(2) the magnetic field is zero only on the axis of the pipe

(3) the magnetic field is different at different points inside the pipe

(4) the magnetic field at any point inside the pipe is zero

28. A portion of a conductive wire is bent in the form of a semicircle of radius r as shown below in fig. At the centre of semicircle, the magnetic induction will be

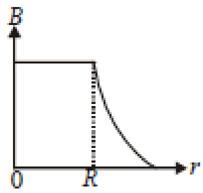


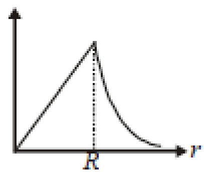
(1) zero (2) infinite (3) $\frac{\mu_0}{4\pi}.\frac{\pi i}{r}$ gauss (4) $\frac{\mu_0}{4\pi}.\frac{\pi i}{r}$ tesla

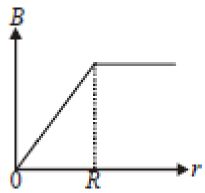
29. A straight wire of diameter 0.5 mm carrying a current of 1 A is replaced by another wire of 1 mm diameter carrying same current. The strength of magnetic field far away is

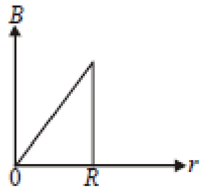
(1) twice the earlier value
(2) same as the earlier value
(3) one-half of the earlier value
(4) one-quarter of the earlier value

30. The correct plot of the magnitude of magnetic field $\vec{B}$ vs distance r from centre of the wire is, if the radius of wire is R

(1) 

(2) 

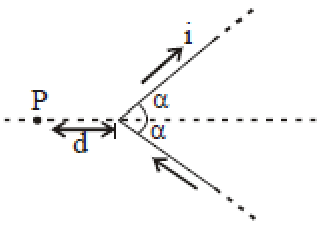
(3) 

(4) 

31. If in a circular coil A of radius R, current I is flowing and in another coil B of radius 2R a current 2I is flowing, then the ratio of the magnetic fields B_A and B_B, produced by them will be

(1) 1 (2) 2 (3) 1/2 (4) 4

32. If the magnetic field at P can be written as K $\tan\left(\frac{\alpha}{2}\right)$, the K is

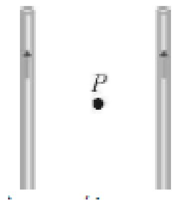


(1) $\frac{\mu_0 I}{4\pi d}$ (2) $\frac{\mu_0 I}{2\pi d}$ (3) $\frac{\mu_0 I}{\pi d}$ (4) $\frac{2\mu_0 I}{\pi d}$

33. A long solenoid has 100 turns per cm and carries a current 6A. The magnetic field at its centre is 3.14×10^{-2} Weber/m^2. Another long solenoid has 50 turns per cm and it carries a current 2A. The value of the magnetic field at its centre is

(1) 5.66×10^{-3} weber/m^2 (2) 5.23×10^{-5} weber/m^2
(3) 7.23×10^{-5} weber/m^2 (4) 6.23×10^{-4} weber/m^2

34. Two long straight wires are set parallel to each other. Each carries a current i in the same direction and the separation between them is $2r$. The intensity of the magnetic field midway between them is

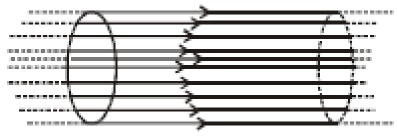


(1) $\mu_0 i/r$ (2) $4\mu_0 i/r$ (3) zero (4) $\mu_0 i/4r$

35. A current loop consists of two identical semicircular parts each of radius R, one lying in the x-y plane and the other in x-z plane. If the current in the loop is i, the resultant magnetic field due to the two semicircular parts at their common centre is

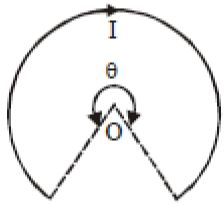
(1) $\frac{\mu_0 i}{\sqrt{2}R}$ (2) $\frac{\mu_0 i}{2\sqrt{2}R}$ (3) $\frac{\mu_0 i}{2R}$ (4) $\frac{\mu_0 i}{4R}$

36. The figure shows n (n being an even number) wires placed along the surface of a cylinder of radius r. Each wire carries current i in the same direction. The net magnetic field on the axis of the cylinder is



(1) $\mu_0 ni$ (2) $\frac{\mu_0 ni}{2\pi r}$ (3) zero (4) $\frac{\mu_0 ni}{4\pi r}$

37. A current of I ampere flows in a wire forming a circular arc of radius r metres subtending an angle θ at the centre as shown. The magnetic field at the centre O in tesla is



(1) $\frac{\mu_0 I\theta}{4\pi r}$ (2) $\frac{\mu_0 I\theta}{2\pi r}$ (3) $\frac{\mu_0 I\theta}{2r}$ (4) $\frac{\mu_0 I\theta}{4r}$

38. The magnetic field at a distance r from a long wire carrying current i is 0.4 tesla. The magnetic field at a distance 2r is

(1) 0.2 tesla (2) 0.8 tesla (3) 0.1 tesla (4) 1.6 tesla

39. The magnetic induction at a point P which is at a distance of 4 cm from a long current carrying wire is 10^{-3} T. The field of induction at a distance 12 cm from the current will be

(1) 3.33×10^{-4} T (2) 1.11×10^{-4} T (3) 3×10^{-3} T (4) 9×10^{-3} T

40. A current i ampere flows along an infinitely long straight thin walled tube, then the magnetic induction at any point inside the tube is

(1) ∞ (2) zero (3) $\frac{\mu_0}{4\pi}.\frac{2i}{r}$ tesla (4) $\frac{2i}{r}$ tesla

41. If we double the radius of a coil keeping the current through it unchanged, then the magnetic field at any point at a large distance from the centre becomes approximately

(1) double (2) three times (3) four times (4) one-fourth

42. Two long parallel wires P and Q are held perpendicular to the plane of paper with distance of 5 m between them. If P and Q carry current of 2.5 amp. and 5 amp. respectively in the same direction, then the magnetic field at a point halfway between the wires is

(1) $\mu_0/17$ (2) $\sqrt{3}\,\mu_0/2p$ (3) $\mu_0/2p$ (4) $3\mu_0/2p$

43. Two concentric circular coils of ten turns each are situated in the same plane. Their radii are 20 and 40 cm and they carry respectively 0.2 and 0.4 ampere current in opposite direction. The magnetic field in weber/m^2 at the centre is

(1) $\mu_0/80$ (2) $7\mu_0/80$ (3) $(5/4)\mu_0$ (4) zero

44. A solenoid of length 1.5 m and 4 cm diameter possesses 10 turns per cm. A current of 5A is flowing through it, the magnetic induction at axis inside the solenoid is ($\mu_0 = 4\pi \times 10^{-7}$ weber amp^{-1} m^{-1})

(1) $4\pi \times 10^{-5}$ gauss (2) $2\pi \times 10^{-5}$ gauss (3) $4\pi \times 10^{-5}$ tesla (4) $2\pi \times 10^{-5}$ tesla

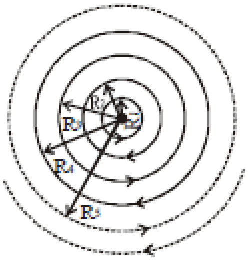
45. At what distance from a long straight wire carrying a current of 12 A will the magnetic field be equal to 3 $\times 10^{-5}$ Wb/m^2?

(1) 8×10^{-2} m (2) 12×10^{-2} m (3) 18×10^{-2} m (4) 24×10^{-2} m

46. A coaxial cable consists of a thin inner conductor fixed along the axis of a hollow outer conductor. The two conductors carry equal currents in opposites directions. Let B_1 and B_2 be the magnetic fields in the region between the conductors and outside the conductor, respectively Then,

(1) $B_1 \neq 0, B_2 \neq 0$ (2) $B_1 = B_2 = 0$ (3) $B_1 \neq 0, B_2 = 0$ (4) $B_1 = 0, B_2 \neq 0$

47. The figure shows a system of infinite concentric circular current loops having radii $R_1, R_2, R_3 \rightarrow R_n$. The loops carry net current *i* alternately in clockwise and anticlockwise direction. The magnitude of net magnetic field of the centre of the loops is



(1) $\frac{\mu_0 i}{2}\left[\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}+\frac{1}{R_4}+....\right]$

(2) $\frac{\mu_0 i}{2}\left[\frac{1}{R_1}-\frac{1}{R_2}+\frac{1}{R_3}-\frac{1}{R_4}+....\right]$

(3) $\frac{\mu_0 i}{4\pi}\left[\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}+\frac{1}{R_4}+....\right]$

(4) $\frac{\mu_0 i}{4\pi}\left[\frac{1}{R_1}-\frac{1}{R_2}+\frac{1}{R_3}-\frac{1}{R_4}+....\right]$

48. Axis of a solid cylinder of infinite length and radius R lies along y-axis, it carries a uniformly distributed current i along +y direction. Magnetic field at a point $\left(\frac{R}{2}y, \frac{R}{2}\right)$ is

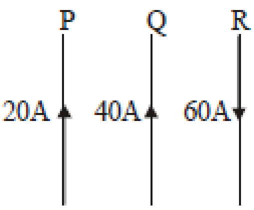
(1) $\frac{\mu_0 i}{4\pi R}\left(\hat{i}-\hat{k}\right)$ (2) $\frac{\mu_0 i}{2\pi R}\left(\hat{j}-\hat{k}\right)$ (3) $\frac{\mu_0 i}{4\pi R}\hat{j}$ (4) $\frac{\mu_0 i}{4\pi R}\left(\hat{i}+\hat{k}\right)$

Topic 3: Force and torque on current carrying conductor and moving coil Galvanometer

49. A current of 10 A is flowing in a wire of length 1.5 m. A force of 15 N acts on it when it is placed in a uniform magnetic field of 2 T. The angle between the magnetic field and the direction of the current is

(1) 30° (2) 45° (3) 60° (4) 90°

50. P, Q and R are long straight wires in air, carrying currents as shown. The force on Q is directed



(1) to the left

(2) to the right

(3) $\perp$ to the plane of the diagram

(4) along the current in Q

51. A current carrying coil is subjected to a uniform magnetic field. The coil will orient so that its plane becomes

(1) inclined at 45° to the magnetic field

(2) inclined at any arbitrary angle to the magnetic field

(3) parallel to the magnetic field

(4) perpendicular to magnetic field

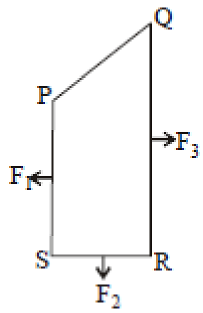
52. Two thin long parallel wires separated by a distance b are carrying a current i amp each. The magnitude of the force per unit length exerted by one wire on the other is

(1) $\frac{\mu_0 i^2}{b^2}$ (2) $\frac{\mu_0 i^2}{2\pi b}$ (3) $\frac{\mu_0 i}{2\pi b}$ (4) $\frac{\mu_0 i}{2\pi b^2}$

53. A current of 5 ampere is flowing in a wire of length 1.5 metres. A force of 7.5 N acts on it when it is placed in a uniform magnetic field of 2 tesla. The angle between the magnetic field and the direction of the current is

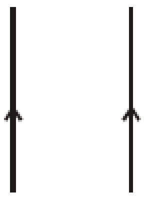
(1) 30° (2) 45° (3) 60° (4) 90°

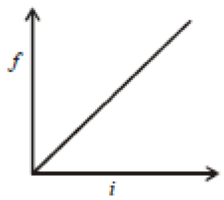
54. A closed loop PQRS carrying a current is placed in a uniform magnetic field. If the magnetic forces on segments PS, SR, and P RQ are F_1, F_2 and F_3 respectively and are in the plane of the paper and along the directions shown, the force on the segment QP is

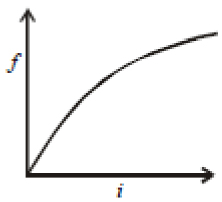


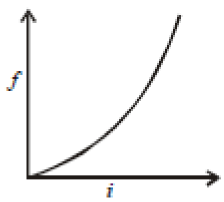
(a) $F_3 - F_1 - F_2$ (2) $\sqrt{(F_3 - F_1)^2 + F_2^2}$ (3) $\sqrt{(F_3 - F_1)^2 - F_2^2}$ (4) $F_3 - F_1 + F_2$

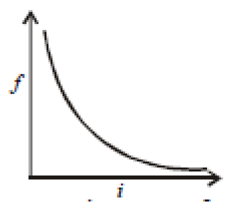
55. The figure shows two long straight current carrying wire separated by a fixed distance *d*. The magnitude of current, flowing in each wire varies with time but the magnitude of current in each wire is equal at all times. Which of the following graphs shows the correct variation of force per unit length *f* between the two wires with current *i*?



(1) 

(2) 

(3) 

(4) 

56. A moving coil galvanometer has a resistance of 900 Ω. In order to send only 10% of the main current through this galvanometer, the resistance of the required shunt is

(1) 0.9 Ω (2) 100 Ω (3) 405 Ω (4) 90 Ω

57. A conducting circular loop of radius *r* carries a constant current *i*. It is placed in a uniform magnetic field $\vec{B}_0$ such that $\vec{B}_0$ is perpendicular to the plane of the loop. The magnetic force acting on the loop is

(1) irB_0 (2) $2\pi irB_0$ (3) zero (4) πirB_0

58. A current of 3 A is flowing in a linear conductor having a length of 40 cm. The conductor is placed in a magnetic field of strength 500 gauss and makes an angle of 30° with the direction of the field. It experiences a force of magnitude

(1) 3×10^{-4} N (2) 3×10^{-2} N (3) 3×10^{2} N (4) 3×10^{4} N

59. In figure, an external torque changes the orientation of loop from one of lowest potential energy to one of highest potential energy. The work done by the external torque is closest to

(1) 0.5 J (2) 0.2 J (3) 0.3 J (4) 0.4 J

60. Through two parallel wires A and B, 10A and 2A of currents are passed respectively in opposite directions. If the wire A is infinitely long and the length of the wire B is 2m, then force on the conductor B, which is situated at 10 cm distance from A, will be

(1) 8×10^{-7} N (2) 8×10^{-5} N (3) 4×10^{-7} N (4) 4×10^{-5} N

61. A circular loop of area 0.02 m2 carrying a current of 10A, is held with its plane perpendicular to a magnetic field induction 0.2 T. The torque acting on the loop is

(1) 0.01 Nm (2) 0.001 Nm (3) zero (4) 0.8 Nm

62. A current carrying conductor placed in a magnetic field experiences maximum force when angle between current and magnetic field is

(1) $3\pi/4$ (2) $\pi/2$ (3) $\pi/4$ (4) zero

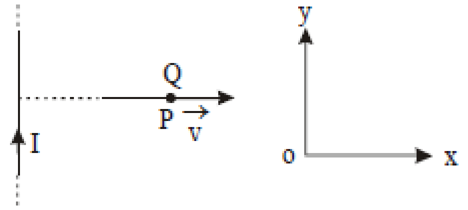
63. To increase the range of voltmeter having resistance G from V to V/n, a shunt of how much resistance should be connected in parallel to it?

(1) n^3G (2) n^2G (3) nG (4) G/n

64. In an ammeter 0.2% of main current passes through the galvanometer. If resistance of galvanometer is G, the resistance of ammeter will be :

(1) $\frac{1}{499}G$ (2) $\frac{499}{500}G$ (3) $\frac{1}{500}G$ (4) $\frac{500}{499}G$

65. A very long straight wire carries a current I. At the instant when a charge + Q at point P has velocity $\vec{v}$, as shown, the force on the charge is



(1) along oy (2) opposite to oy (3) along ox (4) opposite to ox

NEET PREVIOUS YEARS QUESTIONS

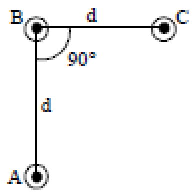
1. Current sensitivity of a moving coil galvanometer is 5 div/ mA and its voltage sensitivity (angular deflection per unit voltage applied) is 20 div/V. The resistance of the galvanometer is [2018]

(1) 40Ω (2) 25Ω (3) 500Ω (4) 250Ω

2. A metallic rod of mass per unit length 0.5 kg m^{-1} is lying horizontally on a smooth inclined plane which makes an angle of 30°with the horizontal. The rod is not allowed to slide down by flowing a current through it when a magnetic field of induction 0.25 T is acting on it in the vertical direction. The current flowing in the rod to keep it stationary is [2018]

(1) 7.14 A (2) 5.98 A (3) 11.32 A (4) 14.76 A

3. An arrangement of three parallel straight wires placed perpendicular to plane of paper carrying same current 'I along the same direction is shown in fig. Magnitude of force per unit length on the middle wire 'B' is given by [2017]

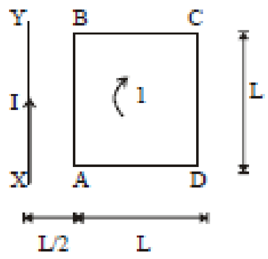


(1) $\frac{2\mu_0 i^2}{\pi d}$ (2) $\frac{\sqrt{2}\mu_0 i^2}{\pi d}$ (3) $\frac{\mu_0 i^2}{\sqrt{2}\pi d}$ (4) $\frac{\mu_0 i^2}{2\pi d}$

4. A 250-turn rectangular coil of length 2.1 cm and width 1.25 cm carries a current of 85 μ A and subjected to magnetic field of strength 0.85 T. Work done for rotating the coil by 180° against the torque is[2017]

(1) 4.55 μ J (2) 2.3 μ J (3) 1.15 μ J (4) 9.1 μ J

5. A square loop ABCD carrying a current i, is placed near and coplanar with a long straight conductor XY carrying a current I, the net force on the loop will be : [2016]



(1) $\frac{2\mu_0 Ii}{3\pi}$ (2) $\frac{\mu_0 Ii}{2\pi}$ (3) $\frac{2\mu_0 IiL}{3\pi}$ (4) $\frac{\mu_0 IiL}{2\pi}$

6. A long straight wire of radius a carries a steady current I. The current is uniformly distributed over its cross-section. The ratio of the magnetic fields B and B', at radial distances a/2 and 2a respectively, from the axis of the wire is: [2016]

(1) 1/4 (2) 1/2 (3) 1 (4) 4

7. A proton and an alpha particle both enter a region of uniform magnetic field B, moving at right angles to field B. If the radius of circular orbits for both the particles is equal and the kinetic energy acquired by proton is 1 MeV the energy acquired by the alpha particle will be: [2015]

(1) 0.5 MeV (2) 1.5 MeV (3) 1 MeV (4) 4 MeV

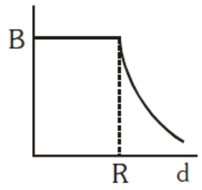
8. An electron moving in a circular orbit of radius r makes n rotations per second. The magnetic field produced at the centre has magnitude: [2015]

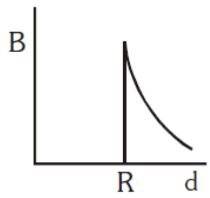
(1) Zero (2) $\frac{\mu_0 n^2 e}{r}$ (3) $\frac{\mu_0 ne}{2r}$ (4) $\frac{\mu_0 ne}{2\pi r}$

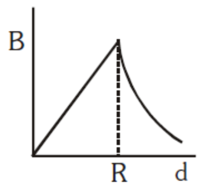
9. Two identical long conducting wires AOB and COD are placed at right angle to each other, with one above other such that 'O' is their common point for the two. The wires carry I_1 and I_2 currents respectively. Point 'P' is lying at distance 'd' from 'O' along a direction perpendicular to the plane containing the wires. The magnetic field at the point 'P' will be: [2014]

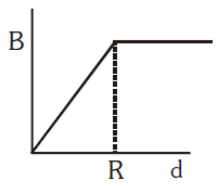
(1) $\frac{\mu_0}{2\pi d}\left(\frac{I_1}{I_2}\right)$ (2) $\frac{\mu_0}{2\pi d}\left(I_1+I_2\right)$ (3) $\frac{\mu_0}{2\pi d}\left(I_1^2-I_2^2\right)$ (4) $\frac{\mu_0}{2\pi d}\left(I_1^2\times I_2^2\right)^{1/2}$

10. A cylindrical conductor of radius R is carrying a constant current. The plot of the magnitude of the magnetic field, B with the distance d, from the centre of the conductor, is correctly represented by the figure: **[NEET – 2019]**

1) 

2) 

3) 

4) 

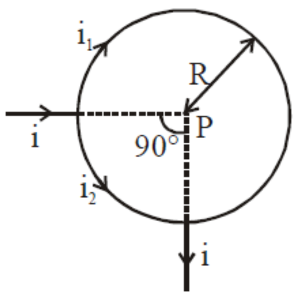
11. Ionized hydrogen atoms and a-particles with same momenta enters perpendicular to a constant magnetic field B. The ratio of their radii of their paths $r_H : r_\alpha$ will be **[NEET – 2019]**

(1) 2 :1 (2) 1 : 2 (3) 4 : 1 (4) 1 : 4

12. Two toroids 1 and 2 have total number of turns 200 and 100 respectively with average radii 40 cm and 20 cm respectively. If they carry same current i, then the ratio of the magnetic fields along the two is : **[NEET – 2019 (ODISSA)]**

(1) 1 : 1 (2) 4 : 1 (3) 2 : 1 (4) 1 : 2

13. A straight conductor carrying current i splits into two parts as shown in the figure. The radius of the circular loop is R. The total magnetic field at the centre P of the loop is : **[NEET – 2019 (ODISSA)]**



(1) Zero (2) $3\mu_0 i/32R$, outward

(3) $3\mu_0 i/32R$, inward (4) $\mu_0 i/2R$, inward

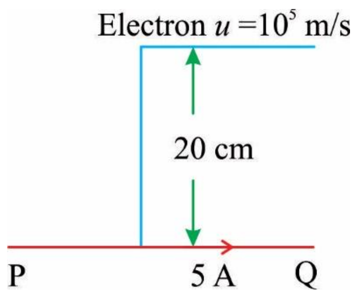
14. A long solenoid of 50 cm length having 100 turns carries a current of 2.5 A. The magnetic field at the centre of the solenoid is $\left(\mu_0 = 4\pi\times10^{-7}\,\text{T m A}^{-1}\right)$ **[NEET – 2020]**

1) 3.14×10^{-5}T 2) 6.28×10^{-4}T 3) 3.14×10^{-4}T 4) 6.28×10^{-5}T

15. An infinitely long straight conductor carries a current of 5A as shown. An electron is moving with a speed

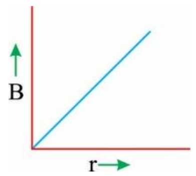
of 10 m/s parallel to the conductor. The perpendicular distance between the electron and the conductor is 20 cm at an instant. Calculate the magnitude of the force experienced by the electron at that instant.

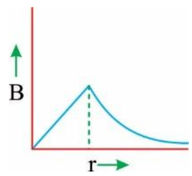
[NEET-2021]

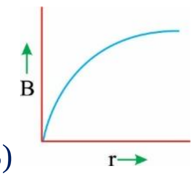


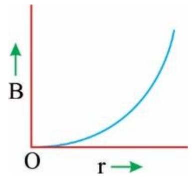
1) $8\pi \times 10^{-20}$ N 2) $4\pi \times 10^{-20}$ N 3) 8×10^{-20} N 4) 4×10^{-20} N

16. A thick current carrying cable of radius 'R' carries current 'I' uniformly distributed across its cross-section. The variation of magnetic field BI due to the cable with the distance 'r' from the axis of the cable is represented by **[NEET-2021]**

1) 

2) 

3) 

4) 

17. In the product $\vec{F} = q\left(\vec{v} \times \vec{B}\right) = q\vec{v} \times \left(B\hat{i} \times B\hat{j} + B_0\hat{k}\right)$

For q = 1 and $\vec{v} = 2\hat{i} + 4\hat{j} + 6\hat{k}$ and $\vec{F} = 4\hat{i} - 20\hat{j} + 12\hat{k}$

What will be the complete expression for $\vec{B}$? **[NEET-2021]**

1) $-6\hat{i} - 6\hat{j} - 8\hat{k}$ 2) $8\hat{i} + 8\hat{j} - 6\hat{k}$ 3) $6\hat{i} + 6\hat{j} - 8\hat{k}$ 4) $-8\hat{i} - 8\hat{j} - 6\hat{k}$

18. A uniform conducting wire of length 12a and resistance 'R' is wound up as a current carrying coil in the shape of **[NEET-2021]**

i) an equilateral triangle of side 'a' ii) a square of side 'a'

The magnetic dipole moments of the coil in each case respectively are

1) $3Ia^2$ and Ia^2 2) $3Ia^2$ and $4Ia^2$ 3) $4Ia^2$ and $3Ia^2$ 4) $\sqrt{3}\,Ia^2$ and $3\,Ia^3$

19. A long solenoid of radius 1 mm has 100 turns per mm. If 1 A current flows in the solenoid, the magnetic field strength at the centre of the solenoid is **[NEET-2022]**

1) $6.28 \times 10^{-2} T$ 2) $12.56 \times 10^{-2} T$ 3) $12.56 \times 10^{-4} T$ 4) $6.28 \times 10^{-4} T$

20. A square loop of side 1 m and resistance 1Ω is placed in a magnetic field of 0.5 T. If the plane of loop is perpendicular to the direction of magnetic field, the magnetic flux through the loop is **[NEET-2022]**

1) 2 weber 2) 0.5 weber 3) 1 weber 4) zero weber

21. Given below are two statements: **[NEET-2022]**

Statements I: Biot-Savert's law gives us the expression for the magnetic field strength of an infinitesimal

current element (Idl) of a current carrying conductor only

Statement II: Biot-Savert's law is analogous to Coulomb's inverse square law of charge q, with the former being related to the field produced by a scalar source, Idl while the latter being produced by a vector source q.

In light of above statements choose the most appropriate answer from the options give below:

1) Both Statement I and Statement II are correct

2) Both Statement I and Statement II are incorrect

3) Statement I is correct but Statement II is incorrect

4) Statement I is incorrect and Statement II is correct

22. From Ampere's circuit law for a long straight wire of circuit cross-section carrying a steady current, the variation of magnitude field in the inside and outside region of the wire is: **[NEET-2022]**

(1) Uniform and remains constant for both the regions.

(2) a linearly increasing function of distance upto the boundary of the wire and then linearly decreasing for the outside region.

(3) a linearly increasing function of distance r upto the boundary of the wire and then decreasing one with 1/r dependence for the outside region.

(4) a linearly decreasing function of distance upto the boundary of the wire and then a linearly increasing one for the outside for the outside region.

NCERT LINE BY LINE QUESTIONS – ANSWERS

1)	c	2)	b	3)	a	4)	b	5)	d
6)	d	7)	b	8)	a	9)	a	10)	a
11)	b	12)	d	13)	c	14)	d	15)	b
16)	a	17)	d	18)	d	19)	d	20)	c

NCERT BASED PRACTICE QUESTIONS

1)	D	2)	D	3)	B	4)	D	5)	A
6)	C	7)	C	8)	D	9)	D	10)	D
11)	D	12)	C	13)	B	14)	A	15)	B
16)	A	17)	B	18)	C	19)	D	20)	C
21)	C	22)	A	23)	B	24)	C	25)	A
26)	B	27)	C	28)	C	29)	C	30)	C
31)	B	32)	D	33)	D	34)	E	35)	A
36)	B	37)	B	38)	C	39)	A	40)	A
41)	D								

TOPIC WISE PRACTICE QUESTIONS - ANSWERS

1)	4	**2)**	2	**3)**	2	**4)**	3	**5)**	1	**6)**	3	**7)**	4	**8)**	1	**9)**	3	**10)**	4
11)	4	**12)**	4	**13)**	2	**14)**	3	**15)**	3	**16)**	3	**17)**	4	**18)**	1	**19)**	4	**20)**	1
21)	4	**22)**	3	**23)**	3	**24)**	2	**25)**	3	**26)**	1	**27)**	4	**28)**	4	**29)**	2	**30)**	2
31)	1	**32)**	2	**33)**	1	**34)**	3	**35)**	2	**36)**	3	**37)**	1	**38)**	1	**39)**	1	**40)**	2
41)	3	**42)**	3	**43)**	4	**44)**	4	**45)**	1	**46)**	3	**47)**	2	**48)**	1	**49)**	1	**50)**	1
51)	4	**52)**	2	**53)**	1	**54)**	2	**55)**	3	**56)**	2	**57)**	3	**58)**	2	**59)**	3	**60)**	2
61)	3	**62)**	3	**63)**	3	**64)**	3	**65)**	1										

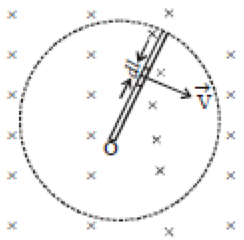
NEET PREVIOUS YEARS QUESTIONS-ANSWERS

1)	4	**2)**	3	**3)**	3	**4)**	4	**5)**	1	**6)**	3	**7)**	3	**8)**	3	**9)**	4
10)	3	**11)**	1	**12)**	1	**13)**	1	**14)**	2	**15)**	3	**16)**	2	**17)**	1	**18)**	4
19)	2	**20)**	2	**21)**	3	**22)**	3										

TOPIC WISE PRACTICE QUESTIONS - SOLUTIONS

1. **(4)** Force, $F = qVB = \frac{mv^2}{R}$ $\therefore R = \frac{mv}{Bq}$

2. **(2)** The application of equation $\vec{F}_B = q\left(\vec{V}\times\vec{B}\right)$ on the element dl of the rod gives force on positive charge towards the outer end. Therefore electrons will move towards pivoted end.



3. **(2)** Here velocity vector have two components

(i) v cosθ, parallel to magnetic field

(ii) v sinθ, perpendicular to magnetic field. Due to component v cosθ, the particle will have a linear motion but due to v sinθ, the particle will have simultaneously a circular motion. The resultant of the two is a helical path.

4. **(3)** As $r = \frac{mv}{qB} = \frac{P}{qB}$

$\therefore$ Area $A = \pi r^2 = \pi\left(\frac{P}{qB}\right)^2 = \frac{\pi P^2}{qB} = \frac{2m\pi}{qB}K$

5. **(1)** Lorentz force acting on the particle

$\overline{F} = q\left[\vec{E} + \vec{v} \times \vec{B}\right]$

$= q\left[3\hat{i} + \hat{j} + 2\hat{k}\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & 4 & 1 \\ 1 & 1 & -3 \end{vmatrix}\right]$

$= q\left[3\hat{i} + \hat{j} + 2\hat{k} + \hat{i}(-12-1) - \hat{j}(-9-1) + \hat{k}(3-4)\right]$

$F_y = 11q\hat{j}$

6. (3) Given: Length of iron rod = L

Magnetic moment of rod = M

Solution: As we know,

Magnetic moment is given by,

M=m×L (1)

According to question, when we bent the rod the pole strength of the rod remains unchanged. However, when the rod is bent in form of a semicircular arc the separation between the two poles become 2r (r is the radius of the semicircular arc).

$\therefore \pi r = L$; $r = \frac{L}{\pi}$

Therefore, the new magnetic moment will be,

M′=m×2r

$M^{|} = m\times = \frac{2L}{\pi} \times \frac{2M}{\pi}$

7. **(4)** The magnetic force acting on the charged particle is given by

$\vec{F} = q\left(\vec{v} \times \vec{B}\right) = \left(-2\times10^{-6}\right)\left[\left\{\left(2\hat{i} + 3\hat{j}\right)\times10^{6}\right\}\times\left(2\hat{j}\right)\right]$

$= -4\left(2\hat{k}\right) = -8\hat{k}$

$\therefore$ Force is of 8N along – z-axis.

8. (1) a) The charged particle will get accelerated in the direction or opposite to the electric field $\vec{E}$ and will not deflected since $\vec{v} \parallel \vec{B}$

b) If $\vec{E} \parallel \vec{B}$, deflection due to magnetic field can be balanced by acceleration due to electric field.

c) $\vec{v} \parallel \vec{B} \Rightarrow \vec{F}_{mag}=0$ Since $\vec{E} \parallel \vec{B}$ the particle will get deflected.

d) $\vec{E} \parallel \vec{B}$; $\vec{v} \parallel \vec{B}$

$\Rightarrow$ the particle will get deflected.

9. (3) Force on a moving charge in a magnetic field is $q\left(\vec{v}\times\vec{B}\right)$

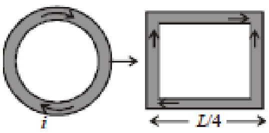
Thus if the particle is moving along the magnetic field, $\vec{F} = 0$.
Hence the particle continues to move along the incident direction, in a straight line.
When the particle is moving perpendicular to the direction of magnetic field, the force is perpendicular to both direction of velocity and the magnetic field.
Then the force tends to move the charged particle in a plane perpendicular to the direction of magnetic field, in a circle.
If the direction of velocity has both parallel and perpendicular components to the direction magnetic field, the perpendicular component tends to move it in a circle and parallel component tends to move it al

10. **(4)** Initially for circular coil $L = 2\pi r$ and $M = i \times \pi r^2$

$$= i\times\pi\left(\frac{L}{2\pi}\right)^2 = \frac{iL^2}{4\pi} \text{-------------(i)}$$

Finally for square coil side $a = \frac{L}{4}$ and

$$M^{|} = i\times\left(\frac{L}{4}\right)^2 = \frac{iL^2}{16} \text{----------------(ii)}$$



Solving equation (i) and (ii) $M^{|} = \frac{\pi M}{4}$

11. **(4)** The change in K.E. is equal to work done by net force which is zero because the magnetic force is perpendicular to velocity. K.E. remains constant.

12. **(4)** $r = \frac{mv}{qB} \Rightarrow r \propto \frac{v}{B}$

13. **(2)** $r = \frac{mv\sin\theta}{Be} = \frac{3\times10^5 \sin 30^0}{0.3\times10^8}$

$$\frac{3\times10^5\times\frac{1}{2}}{3\times10^7} = 0.5\times10^{-2}m = 0.5cm$$

14. **(3)** The electron moves with constant velocity without deflection. Hence, force due to magnetic field is equal and opposite to force due to electric field.

$$qvB = qE \Rightarrow v = \frac{E}{B} = \frac{20}{0.5} = 40\,m/s$$

15. **(3)** $r=\dfrac{mv}{qB}$ or $r\propto v$

As v is doubled, the radius also becomes double.

Hence, radius = 2 × 2 = 4 cm.

16. (3) (i) When no field is present E=0,B=0, the proton experiences no force. Thus it moves with a constant velocity.

(ii) When E=0 and B=0, then there will be a probability that proton may move parallel to magnetic field. In this situation, there will be no force acting on proton.

(iii) When both fields are present

E=0,B=0, then let E, B and v may be mutually perpendicular to each other. In this case, the electric and magnetic forces acting on the proton may be equal and opposite. Thus, there will be no resultant force on the proton.

17. **(4)** Magnetic moment m = IA

Since $T=\dfrac{2\pi R}{v}$ Also, $I=\dfrac{q}{T}=\dfrac{qv}{2\pi R}$

$\therefore m=\left(\dfrac{qv}{2\pi R}\right)\left(\pi R^2\right)=\dfrac{qvR}{2}$

18. **(1)** $\vec{F}\propto\left(\vec{v}\times\vec{B}\right)=\hat{k}\left[aD-dA\right]$

19. **(4)** $F=qvB\sin\theta\Rightarrow B=\dfrac{F}{qv\sin\theta}$

$B_{\min}=\dfrac{F}{qv}$ (when $\theta=90^0$)

$=\dfrac{10^{-10}}{10^{-12}\times10^{5}}=10^{-3}$ Tesla in $\hat{z}$ - direction

20. **(1)** F=qE+q(v×B)

this is loranze force

21. **(4)** $v=\dfrac{Bqr}{m}=\dfrac{4.5\times10^{-3}\times1.6\times10^{-19}\times2\times10^{-2}}{9.1\times10^{-31}}=1.58\times10^{7}\,m/s$

22. **(3)** Time taken by proton to make one revolution

$=\dfrac{25}{5}=5\mu\sec$

As $T=\dfrac{2\pi m}{qB}$; so $\dfrac{T_2}{T_1}=\dfrac{m_2}{m_1}\times\dfrac{q_1}{q_2}$

or $T_2=T_1\dfrac{m_2q_1}{m_1q_2}=\dfrac{5\times4m_1}{m_1}\times\dfrac{q}{2q}=10\mu\sec$

23. **(3)** If r is the radius of the circle,

then $L=2\pi r$ or, $r=\dfrac{L}{2\pi}$

Area $=\pi r^2=\pi L^2/4\pi^2=L^2/4\pi$

24. **(2)** Cyclotron frequency $=\mathrm{f}=\dfrac{\mathrm{qB}}{2\pi\mathrm{m}}$

$\mathrm{f}=\dfrac{100\times1.6\times10^{-19}\times10^{-4}}{2\pi\times9.1\times10^{-31}}=2.8\mathrm{MHz}$

25. **(3)** E = vB = $2\times10^3\times1.5=3\times10^3$ N/C

26. **(1)** $K.E = 6\times10^{-16}J$; $\frac{1}{2}MV^2 = 6\times10^{-16}$

$$V = \sqrt{\frac{12\times10^{-16}}{M}}\ ;\ r = \frac{MV}{qB} = \frac{M\sqrt{\frac{12\times10^{-16}}{M}}}{1.6\times10^{-19}\times6\times10^{-3}}$$

$$= \sqrt{\frac{9.18\times10^{-31}\times12\times10^{-16}}{1.6\times6\times10^{-22}}}$$

$$r = \frac{33.045\times10^{-24}}{9.6\times10^{-22}} = 3.42\,cm$$

27. **(4)** There is no current inside the pipe. Therefore

$$\oint \bar{B}.\bar{d\ell} = \mu_0 I \Rightarrow I = 0,\ B = 0$$

28. **(4)** The straight part will not contribute magnetic field at the centre of the semicircle because every element of the straight part will be 0º or 180º with the line joining the centre and the element

Due to circular portion, the field is $\frac{1}{2}\frac{\mu_0 i}{2r} = \frac{\mu_0 i}{4r}$

Hence total field at $O = \frac{\mu_0 i}{4r}$

29. **(2)** $B = \frac{\mu_0 i}{2\pi r}$ and so it is independent of thickness.

The current is same in both the wires, hence magnetic field induced will be same.

30. **(2)** The magnetic field from the centre of wire of radius R is given by

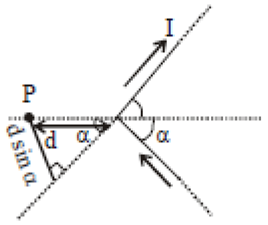
$$B = \left(\frac{\mu_0 I}{2R^2}\right)r\ (r < R) \Rightarrow B \propto r \ \text{ and } \ B = \frac{\mu_0 I}{2\pi r}\ (r > R) \Rightarrow B \propto \frac{1}{r}$$

From the above descriptions, we can say that the graph (2) is a correct representation.

31. **(1)** In coil A, $B = \frac{\mu_0}{4\pi}\frac{2\pi I}{R}$; $\therefore B \propto \frac{I}{R}$

Hence, $\frac{B_1}{B_2} = \frac{I_1}{R_1}.\frac{R_2}{I_2} = \frac{2}{2} = 1$

32. **(2)**



Let us compute the magnetic field due to any one segment:

$$B = \frac{\mu_0 I}{4\pi(d\sin\alpha)}\left(\cos 0^0 + \cos(180-\alpha)\right)$$

$$= \frac{\mu_0 I}{4\pi(d\sin\alpha)}(1-\cos\alpha) = \frac{\mu_0 I}{4\pi d}\tan\frac{\alpha}{2}$$

Resultant field will be

$$B_{net} = 2B = \frac{\mu_0 I}{2\pi d}\tan\frac{\alpha}{2} \Rightarrow K = \frac{\mu_0 I}{2\pi d}$$

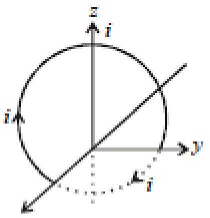
33. **(1)** $B = \mu_0 ni$; $\frac{B_1}{B_2} = \frac{n_1}{n_2}\frac{i_1}{i_2}$

$$\frac{3.14\times10^{-2}}{B_2} = \frac{100\times6}{50\times2} \Rightarrow B_2 = 5.66\times10^{-3}\,\text{web}/\text{m}^2$$

34. **(3)** $B = \frac{\mu_0}{2\pi}.\frac{i}{r} - \frac{\mu_0}{2\pi}.\frac{i}{r} = 0$

35. **(2)** Magnetic fields due to the two parts at their common centre are respectively,

$B_y = \frac{\mu_0 i}{4R}$ and $B_z = \frac{\mu_0 i}{4R}$



Resultant field $= \sqrt{B_y^2 + B_z^2}$

$$= \sqrt{\left(\frac{\mu_0 i}{4R}\right)^2 + \left(\frac{\mu_0 i}{4R}\right)^2}$$

$$= \sqrt{2}.\frac{\mu_0 i}{4R} = \frac{\mu_0 i}{2\sqrt{2}R}$$

36. **(3)** Since *n* is an even number, we can assume the wires in pairs such that the two wires forming a pair is placed diametrically opposite to each other on the surface of cylinder. The fields produced on the axis by them are equal and opposite and can get cancelled with each other.

37. **(1)** $B = \frac{\mu_0 I}{2r}\times\frac{\theta}{2\pi} = \frac{\mu_0 I\theta}{4\pi r}$

38. **(1)** $B = \frac{\mu_0 I}{2\pi r}$ *or* $B \propto \frac{1}{r}$

When *r* is doubled, the magnetic field becomes half, i.e., now the magnetic field will be 0.2 T.

39. **(1)** $B = \frac{\mu_0 I}{2\pi r} \Rightarrow B \propto \frac{1}{r}$

As the distance is increased to three times, the magnetic induction reduces to one third. Hence,

$$B = \frac{1}{3}\times10^{-3}\,telsa = 3.33\times10^{-4}\,tesla$$

40. **(2)** Magnetic induction inside a thin walled tube is zero. (According to Ampere's Law)

41. **(3)** $B_{axis} = \left(\frac{\mu_0 NI}{2x^3}\right)R^2$; $B \propto R^2$

So, when radius is doubled, magnetic field becomes four times.

42. **(3)** $B = \frac{\mu_0}{4\pi}\frac{2i_2}{(r/2)} - \frac{\mu_0}{4\pi}\frac{2i_1}{(r/2)} = \frac{\mu_0}{4\pi}\frac{4}{r}(i_2 - i_1)$

$$= \frac{\mu_0}{4\pi}\frac{4}{5}(5-2.5) = \frac{\mu_0}{2\pi}$$

43. **(4)** $B=\frac{\mu_0}{4\pi}\cdot\frac{2\pi ni_1}{r_1}-\frac{\mu_0}{4\pi}\frac{2\pi ni_2}{r_2}=\frac{\mu_0}{2}\left[\frac{ni_1}{r_1}-\frac{ni_2}{r_2}\right]$

44. **(4)** $B=\mu_0 nI=4\pi\times10^{-7}\times10\times5=2\pi\times10^{-5}T$

45. **(1)** Current (I) = 12 A and magnetic field (2) = 3×10^{-5} Wb/m^2. Consider magnetic field $\vec{B}$ at distance r.

Magnetic field, $B=\frac{\mu_0 I}{2\pi r}$

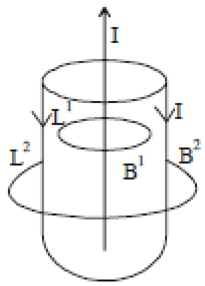
$$\Rightarrow r=\frac{\mu_0 I}{2\pi B}=\frac{(4\pi\times10^{-7})\times12}{2\times\pi\times(3\times10^{-5})}=8\times10^{-2}m$$

46. **(3)** Apply Ampere's circular law to the coaxial circular loops L_1 and L_2

The magnetic field is B_1 at all points on L_1 and B_2 at all points of L_2. $\sum I\neq0$ for L_1 and 0 for L_2.

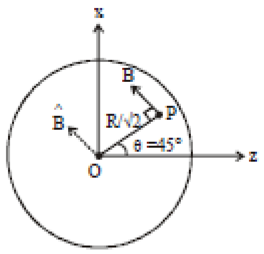
Hence, $B_1\neq0$ but $B_2=0$

$\left[As\ \oint\vec{B}.d\vec{l}=\mu_0\sum I\right]$



47. **(2)** Field at the centre of a circular current loop is given by $B=\frac{\mu i}{2R}$. Since the currents are alternately in opposite directions therefore the correct net field at centre is given by vector sum of field produced by each loop which are alternately in opposite directions.

48. **(1)** The magnitude of magnetic field at P



(independent on y-coordinate)

Unit vector in direction of magnetic field is

$\hat{B}=\frac{\hat{i}-\hat{k}}{\sqrt{2}}$ (shown by dotted lines)

$\therefore\vec{B}=B\hat{B}=\frac{\mu_0 i}{4\pi R}(\hat{i}-\hat{k})$

49. **(1)** $F=IlB\sin\theta$ or $\sin\theta=\frac{F}{IlB}$

50. **(1)** Parallel current attracts while opposite current repel each other.

51. (4) A current carrying coil behaves as a magnetic dipole. Therefore, in a uniform magnetic field coil will get aligned such that the dipole moment of the coil is parallel to the magnetic field. And we know that dipole moment

of a coil is perpendicular to its plane.
Therefore, coil will align itself such that its plane is perpendicular the direction of magnetic field.

52. **(2)** Given $i_1 = i_2 = i$

$$\therefore F = \frac{\mu_0 i^2 l}{2\pi b}$$

Hence force per unit length is $F = \frac{\mu_0 i^2}{2\pi b}$

53. **(1)** $F = Bil\sin\theta \Rightarrow 7.5 = 2\times5\times1.5\sin\theta \Rightarrow \theta = 30^0$

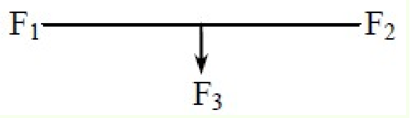
54. **(2)**

55. **(3)** The force per unit length is given by $f = \frac{\mu_0 i^2}{2\pi d}$

i.e., $f \propto i^2$

56. **(2)** $I_g = 0.1I$, $I_s = 0.9\,I$; $S = I_g R_g / I_s$
$= 0.1\times900 / 0.9 = 100\,\Omega$.

57. (3) Total force on the current carrying closed loop
should be zero, if placed in uniform magnetic field.



$F_{horizontal}=(F_3-F_1)$
$F_{vertical}=F_2$

Resultant of $\vec{F}_1, \vec{F}_2$ and $\vec{F}_3$ is $\vec{F}$

where $F = \sqrt{(F_3 - F_1)^2 + F_2^2}$

Since total force = 0, hence force on QP is equal
to F in magnitude but opposite direction.

58. (2) Force on a current carrying conductor is given as F=ILB sin θ where θ is angle between length L and field B.
i.e. 30^0
Put $B=500\times10^{-4}$Tesla and L=0.4m with I =3A we get
$F=3\times10^{-2}$N so n=3

59. (3) The potential energy of a current carrying loop kept in external magnetic field is
$U = -\vec{M}\vec{B}$
Hence work done in moving form lowest potential energy to highest potential energy=MB−(−MB)=2MB
=2×0.75×0.2J =0.3J

60. **(2)** $F = \frac{\mu_0}{4\pi}\frac{2I_1I_2}{r}\times1$

$$= \frac{10^{-7}\times2\times10\times2}{0.1}\times2 = 8\times10^{-5}\,N$$

61. **(3)** Area (1) = 0.01 m^2; Current (I) = 10A;
Angle $(\phi) = 90^0$ and magnetic field (2) =0.1T
Therefore actual angle $\theta = (90^0 - \phi) = (90^0 - 90^0) = 0^0$

And torque acting on the loop $(\tau) = IAB\sin\theta$

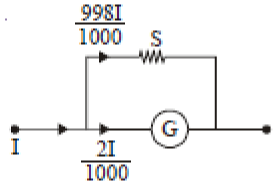
$= 10 \times 0.01 \times 0.1 \times \sin 0^0 = 0$

62. (3) F=iB$l$sinθ. This is maximum when sinθ=1 or θ=π/2.

63. **(3)** $R = (n-1)G$; $R^{|} = Gn - G + G = nG$

64. **(3)** As 0.2% of main current passes through the galvanometer hence $\frac{998}{1000}I$ current through the shunt.

$$\left(\frac{2I}{1000}\right)G = \left(\frac{998I}{1000}\right)S \Rightarrow S = \frac{G}{499}$$



Total resistance of Ammeter

$$R = \frac{SG}{S+G} = \frac{\left(\frac{G}{499}\right)G}{\left(\frac{G}{499}\right)+G} = \frac{G}{500}$$

65. **(1)** The direction of B is along $\left(-\hat{k}\right)$

$\therefore$ The magnetic force

$$\vec{F} = Q\left(\vec{v}\times\vec{B}\right) = Q\left(v\hat{i}\right)\times B\left(-\hat{k}\right) = QvB\hat{j}$$

NEET PREVIOUS YEARS QUESTIONS-EXPLANATIONS

1. **(4)** Current sensitivity of moving coil galvanometer

$$I_s = \frac{NBA}{C} \text{ ....(i)}$$

Voltage sensitivity of moving coil galvanometer,

$$V_s = \frac{NBA}{CR_G} \text{ ...(ii)}$$

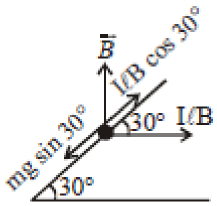
Dividing eqn. (i) by (ii)

Resistance of galvanometer

$$R_G = \frac{I_s}{V_s} = \frac{5\times 1}{20\times 10^{-3}} = \frac{5000}{20} = 250\Omega$$

2. **(3)** From figure, for equilibrium,

mg sin 30° = I/B cos30°

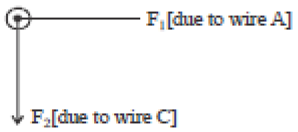


$$\Rightarrow I = \frac{mg}{\ell B}\tan 30^0$$

$$= \frac{0.5\times 9.8}{0.25\times\sqrt{3}} = 11.32A$$

3. **(3)** Force per unit length between two parallel current carrying conductors, $F = \frac{\mu_0 i_1 i_2}{2\pi d}$

Since same current flowing through both the wires $i_1 = i_2 = I$, so $F_1 = \frac{\mu_0 i^2}{2\pi d} = F_2$



$\therefore$ Magnitude of force per unit length on the middle wire 'B'

$$F_{net} = \sqrt{F_1^2 + F_2^2} = \frac{\mu_0 i^2}{\sqrt{2}\pi d}$$

4. **(4)** Work done, $W = MB(\cos\theta_1 - \cos\theta_2)$

When it is rotated by angle 180° then

$W = MB(\cos 0° - \cos 180°) = MB(1 + 1)$

$W = 2MB = 2(NIA)B$

$= 2 \times 250 \times 85 \times 10^{-6}[1.25 \times 2.1 \times 10^{-4}] \times 85 \times 10^{-2} = 9.1$ mJ

5. **(1)** The direction of current in conductor XY and AB is same

$\therefore F_{AB} = i\ell B$ (attractive)

$$F_{AB} = \frac{\mu_0 iI}{\pi}(\leftarrow)$$

F_{BC} opposite to $F_{AD} = = \frac{\mu_0 iI}{3\pi}(\rightarrow)$

Therefore the net force on the loop

$F_{net} = F_{AB} + F_{BC} + F_{CD} + F_{AD}$

$$\Rightarrow F_{net} = \frac{\mu_0 iI}{\pi} - \frac{\mu_0 iI}{3\pi} = \frac{2\mu_0 iI}{3\pi}$$

6. (3) Consider two amperian loops of radius a/2 and 2a as shown in the diagram.

Applying ampere's circuital law for these loops, we get

$\oint B.dL = \mu_0 I_{enclosed}$

For the smaller loop,

$$\Rightarrow B\times 2\pi\frac{a}{2} = \mu_0 \times \frac{1}{\pi a^2}\times\left(\frac{a}{2}\right)^2$$

$$= \mu_0 I\times\frac{1}{4} = = \frac{\mu_0 I}{4}$$

$\Rightarrow B_1 = \frac{\mu_0 I}{4\pi a}$

$B' \times 2\pi(2a) = \mu_0 I$

$\frac{B}{B^{|}} = \frac{\mu_0 I}{4\pi a} \times \frac{4\pi a}{\mu_0 I} = 1$

7. **(3)** As we know, $F = qvB = \frac{mv^2}{R}$

$\therefore R = \frac{mv}{qB} = \frac{\sqrt{2m(kE)}}{qB}$

Since R is same so, $KE \propto \frac{q^2}{m}$

Therefore KE of a particle

$= \frac{q^2}{m} = \frac{(2)^2}{4} = 1MeV$

8. **(3)** Radius of circular orbit = r

No. of rotations per second = n

i.e., $T = \frac{1}{n}$

Magnetic field at its centre, B_c =?

As we know, current

$i = \frac{e}{T} = \frac{e}{(1/n)} = en = \text{equivalent current}$

Magnetic field at the centre of circular orbit,

$B_c = \frac{\mu_0 i}{2r} = \frac{\mu_0 ne}{2r}$

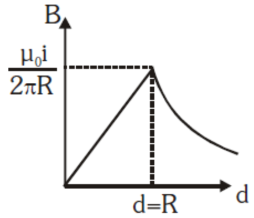
9. **(4)** Net magnetic field, $B = \sqrt{B_1^2 + B_2^2}$

$\sqrt{\left(\frac{\mu_0 I_1}{2\pi d}\right)^2 + \left(\frac{\mu_0 I_2}{2\pi d}\right)^2} \quad \left(\because B_1 = \frac{\mu_0 I_1}{2\pi d} \text{ and } B_2 = \frac{\mu_0 I_2}{2\pi d}\right)$

$= \frac{\mu_0}{2\pi d}\sqrt{I_1^2 + I_2^2}$

10.

$$B = \begin{cases} \frac{\mu_0 id}{2\pi R^2} & : \quad d \le R \\ \frac{\mu_0 i}{2\pi d} & : \quad d > R \end{cases}$$



11. $\frac{q_H}{q_\alpha}=\frac{1}{2}$ $\qquad r=\frac{mv}{qB}$

For same momenta, $r \propto \frac{1}{q}$

$$\frac{r_H}{r_\alpha}=\frac{q_\alpha}{q_H}=\frac{2}{1}$$

12. For a toroid magnetic field, $B=\mu_0 ni$

Where, n= number of turns per unit length $=\frac{N}{2\pi r}$

Now, $\frac{B_1}{B_2}=\frac{\mu_0 n_1 i}{\mu_0 n_2 i}$

$\frac{n_1}{n_2}=\frac{N_1}{2\pi r_1}\times\frac{2\pi r_2}{N_2}$

$\Rightarrow \frac{B_1}{B_2}=\frac{200}{2\pi\times 40\times 10^{-2}}\times\frac{2\pi\times 20\times 10^{-2}}{100}$

$\Rightarrow \frac{B_1}{B_2}=\frac{1}{1}\Rightarrow B_1:B_2=1:1$

13. Magnetic field due to $i_1=\frac{\mu_0 i_1}{2R}\frac{\theta_1}{2\pi}$

(Into the plane)

Magnetic field due to $i_2=\frac{\mu_0 i_2}{2R}\frac{\theta_2}{2\pi}$

(out of the plane)

For parallel combination $\frac{i_1}{i_2}=\frac{\rho l_2}{A}\times\frac{A}{\rho l_1}=\frac{l_1}{l_2}$

$\Rightarrow \frac{i_1}{i_2}=\frac{\frac{1}{4}(2\pi R)}{\frac{3}{4}(2\pi R)}=\frac{1}{3}$

$\Rightarrow i_1=\frac{i_2}{3}\Rightarrow i_2=3i_1$

$\therefore$ Net magnetic field

$=\frac{\mu_0 i_1}{2R}\left(\frac{\theta_1}{2\pi}\right)-\frac{\mu_0 i_2}{2R}\left(\frac{\theta_2}{2\pi}\right)$

$=\frac{\mu_0}{2R}\left(\frac{3\pi}{2\times 2\pi}\right)-\frac{\mu_0 i_2}{2R}\left(\frac{\pi}{2\times 2\pi}\right)$

$=\frac{\mu_0}{2R}\left[\frac{3i_1}{4}-\frac{i_2}{4}\right]$

$=\frac{\mu_0}{2R}\left[\frac{3i_1}{4}-\frac{3i_1}{4}\right]=0$

14. $B=\mu_0 ni=4\pi\times 10^{-7}\times\frac{100}{50\times 10^{-2}}\times 2.5=6.28\times 10^{-4}T$

15. $B=\frac{\mu_0 l}{2\pi r}=\frac{2\times10^{-7}\times5}{20\times10^{-2}}=5\times10^{-6}$

$F=quB=\left(1.6\times10^{-19}\right)(10^5)5\times10^{-6}=8\times10^{-20}\,N$

16. $B_{in}=\frac{\mu_0}{2\pi}\frac{ir}{R^2}$; $B_{out}=\frac{\mu_0}{2\pi}\frac{i}{r}$

17. $\vec{F}=q\left(\vec{v}\times\vec{B}\right)$

$=q\vec{v}\times\left(B\hat{i}+B\hat{j}+B_0\hat{k}\right)$

Given $q=1,\vec{v}=\left(2\hat{i}+4\hat{j}+6\hat{k}\right)$ *and* $\vec{F}=\left(4\hat{i}-20\hat{j}+12\hat{k}\right)$

$\Rightarrow\left(4\hat{i}-20\hat{j}+12\hat{k}\right)=-1\times\left(2\hat{i}+4\hat{j}+6\hat{k}\right)\times\left(B\hat{i}+B\hat{j}+B_0\hat{k}\right)$

Thus, calculating values of RHS,

$$\begin{vmatrix}\hat{i} & \hat{j} & \hat{k}\\ 2 & 4 & 6\\ B & B & B_0\end{vmatrix}$$

$\Rightarrow\ i(4B_0-6B)-j(2B_0-6B)+\hat{k}(2B-4B)$

Comparing L.H.S and R.H.S,

$4B_0-6B-4\Rightarrow 2B_0-3B=2........(1)$

$-\left(2B_0-6B\right)=-20\Rightarrow B_0-3B=10........(2)$

$2B-4B=12\Rightarrow B=-6...............(3)$

From (2) and (3)

$B = -6$ and $B_0 = -8$

Hence , $\vec{B}=-6\hat{i}-6\hat{j}-8\hat{k}$

18. Current in the loop will be V/R = I which is same for both loops.

Now magnetic moment of Triangle loop = NIA

$M_1=\left(\frac{12a}{3a}\right)\cdot I\cdot\frac{\sqrt{3}}{4}a^2=\sqrt{3}Ia^2$

and magnetic moment of square loop = N′IA′

$=\left(\frac{12a}{4a}\right)\cdot I\cdot a^2$ $M_2=3Ia^2$

19. $B=\mu_0 ni$

$=4\pi\times10^{-7}\times\frac{100}{10^{-3}}\times1\quad=12.56\times10^{-2}T$

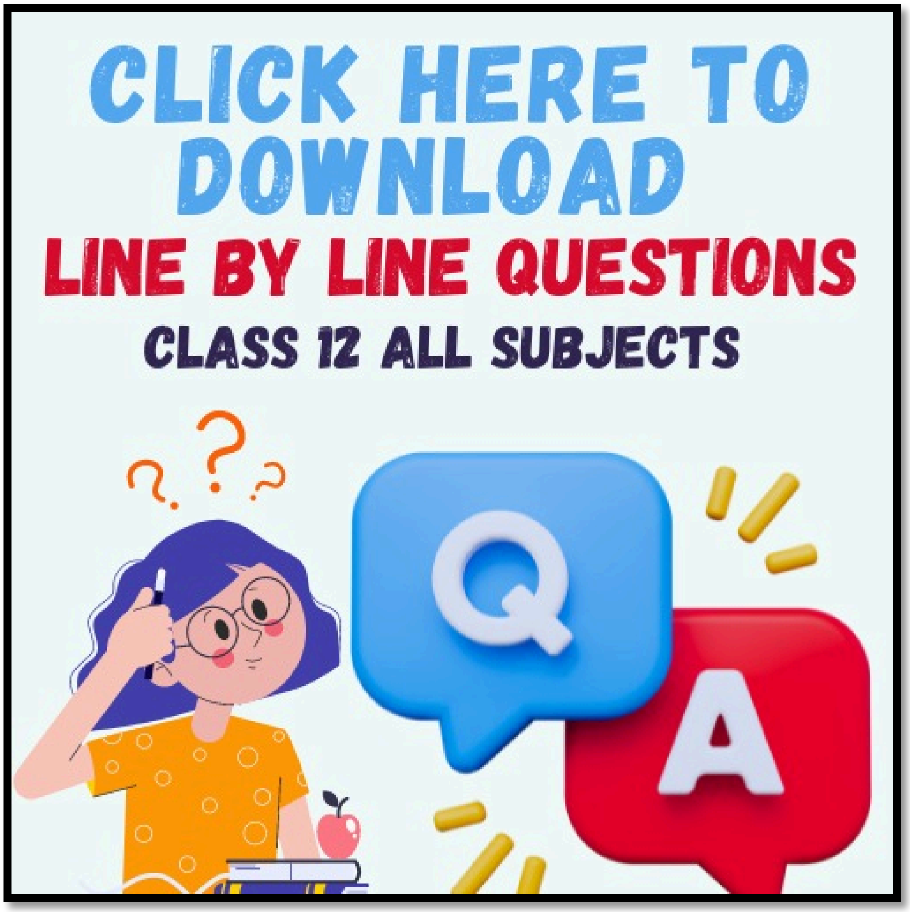
20. $\phi=BA\cos\theta=0.5\times1^2=0.5$

21. Statement I is correct, Statement II is wrong because Idl is a vector source while in case of coulomb law, charge is a scalar source.

22. $B=\frac{\mu_0 i}{2\pi r}$ when $r>R$

$$B = \frac{\mu_0 i}{2\pi R} \text{ when } r = R$$

$$B = \frac{\mu_0 i r}{2\pi R^2} \text{ when } r < R$$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- **Free and Unlimited Resources:** Members enjoy the benefit of accessing an array of educational resources without any cost restrictions. Whether its study materials, teaching aids, or assessment tools, the group offers an abundance of resources tailored to individual needs. This accessibility ensures that educators and students have ample support in their academic endeavors without financial constraints.

- **Instant Access to Educational Content:** SOE WhatsApp groups are a platform where teachers can access a wide range of educational content instantly. This includes study materials, notes, sample papers, reference materials, and relevant links shared by group members and moderators.

- **Timely Updates and Reminders:** SOE WhatsApp groups serve as a source of timely updates and reminders about important dates, exam schedules, syllabus changes, and academic events. Teachers can stay informed and well-prepared for upcoming assessments and activities.

- **Interactive Learning Environment:** Teachers can engage in discussions, ask questions, and seek clarifications within the group, creating an interactive learning environment. This fosters collaboration, peer learning, and knowledge sharing among group members, enhancing understanding and retention of concepts.

- **Access to Expert Guidance:** SOE WhatsApp groups are moderated by subject matter experts, teachers, or experienced educators can benefit from their guidance, expertise, and insights on various academic topics, exam strategies, and study techniques.

Join the School of Educators WhatsApp Group today and unlock a world of resources, support, and collaboration to take your teaching to new heights. To join, simply click on the group links provided below or send a message to +91-95208-77777 expressing your interest.

Together, let's empower ourselves & Our Students and inspire the next generation of learners.

Best Regards,
Team
School of Educators

Join School of Educators WhatsApp Groups

You will get Pre- Board Papers PDF, Word file, PPT, Lesson Plan, Worksheet, practical tips and Viva questions, reference books, smart content, curriculum, syllabus, marking scheme, toppers answer scripts, revised exam pattern, revised syllabus, Blue Print etc. here . Join Your Subject / Class WhatsApp Group.

Kindergarten to Class XII (For Teachers Only)

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Class 2

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Class 3

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Class 4

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Class 11 (Science)

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Class 11 (Humanities)

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Class 11 (Commerce)

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Class 12 (Science)

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Class 12 (Humanities)

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Kindergarten

Subject Wise Secondary and Senior Secondary Groups (IX & X For Teachers Only)

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IT Code-402

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Hindi-B

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Senior Secondary Groups (XI & XII For Teachers Only)

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Entrepreneurship

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Artificial Intelligence

Other Important Groups (For Teachers & Principal’s)

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Teachers Jobs

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IT

Click Here to Join
AI

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IIT/NEET

Click Here to Join
CUET

Groups Rules & Regulations:

To maximize the benefits of these WhatsApp groups, follow these guidelines:

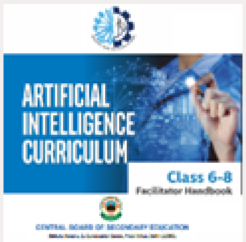
1. Share your valuable resources with the group.
2. Help your fellow educators by answering their queries.
3. Watch and engage with shared videos in the group.
4. Distribute WhatsApp group resources among your students.
5. Encourage your colleagues to join these groups.

Additional notes:

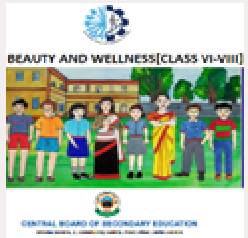
1. Avoid posting messages between 9 PM and 7 AM.
2. After sharing resources with students, consider deleting outdated data if necessary.
3. It's a NO Nuisance groups, single nuisance and you will be removed.
   - No introductions.
   - No greetings or wish messages.
   - No personal chats or messages.
   - No spam. Or voice calls
   - Share and seek learning resources only.

Please only share and request learning resources. For assistance, contact the helpline via WhatsApp: +91-95208-77777.

SKILL MODULES BEING OFFERED IN MIDDLE SCHOOL

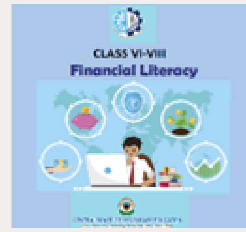


Artificial Intelligence



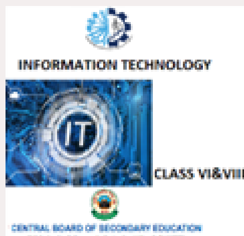
Beauty & Wellness

Design Thinking & Innovation



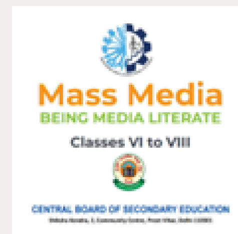
Financial Literacy

Handicrafts

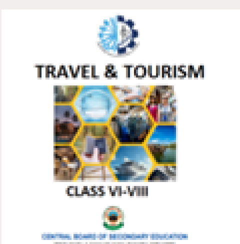


Information Technology

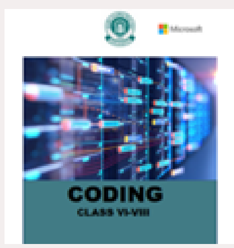
Marketing/Commercial Application



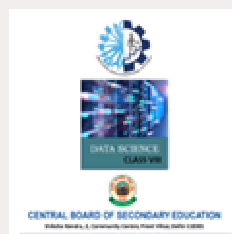
Mass Media - Being Media Literate



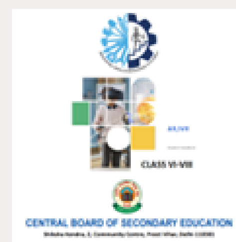
Travel & Tourism



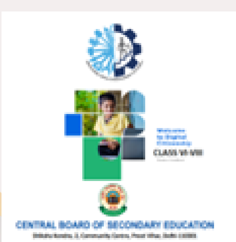
Coding



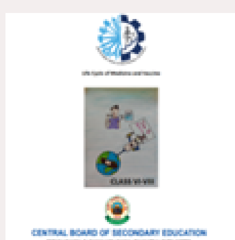
Data Science (Class VIII only)



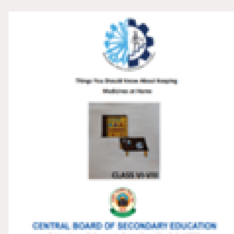
Augmented Reality / Virtual Reality



Digital Citizenship

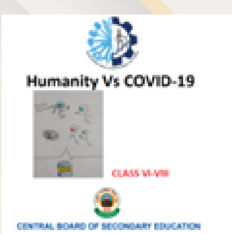


Life Cycle of Medicine & Vaccine

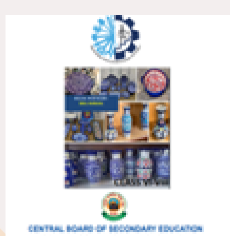


Things you should know about keeping Medicines at home

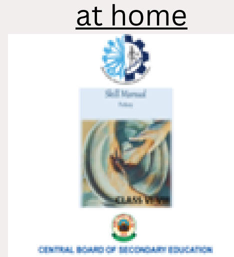
What to do when Doctor is not around



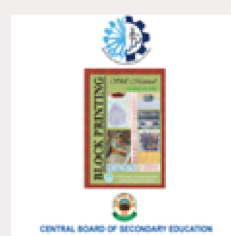
Humanity & Covid-19



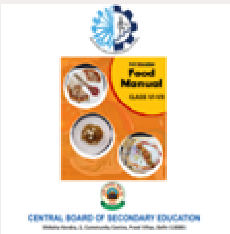
Blue Pottery



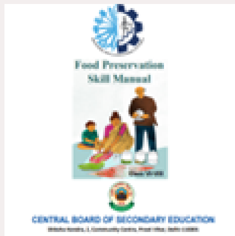
Pottery



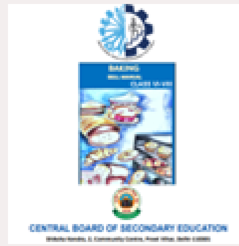
Block Printing



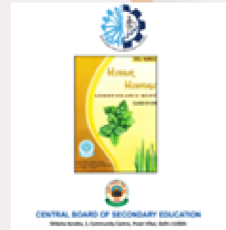
Food



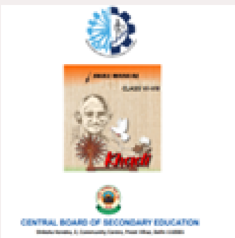
Food Preservation



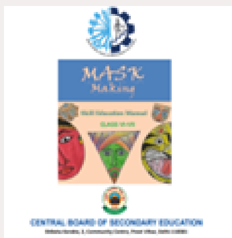
Baking



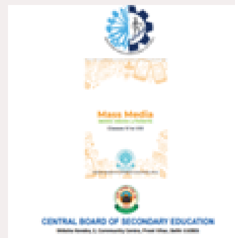
Herbal Heritage



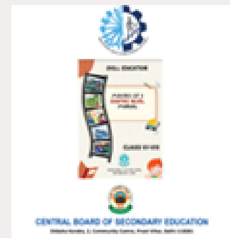
Khadi



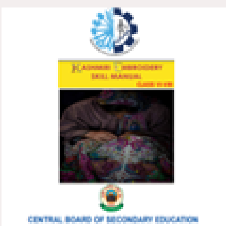
Mask Making



Mass Media

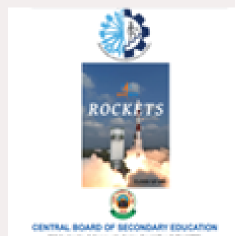


Making of a Graphic Novel

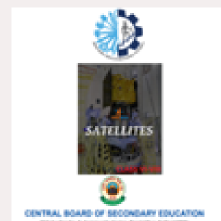


Kashmiri Embroidery

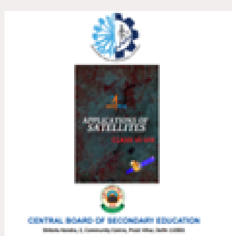
Embroidery



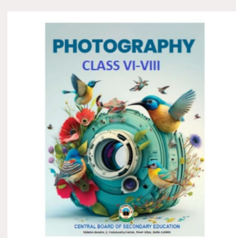
Rockets



Satellites

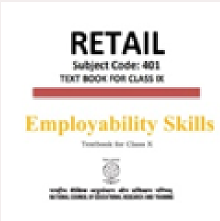


Application of Satellites



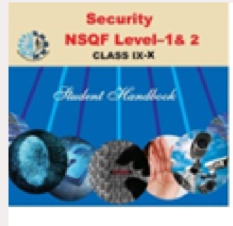
Photography

SKILL SUBJECTS AT SECONDARY LEVEL (CLASSES IX – X)

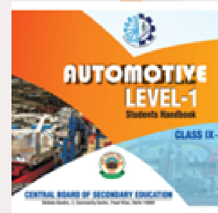


Retail

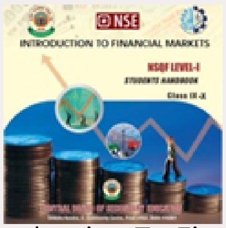
Information Technology



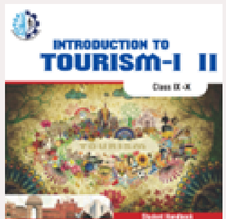
Security



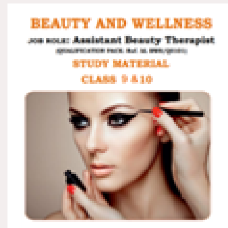
Automotive



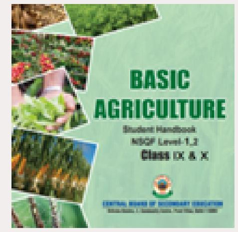
Introduction To Financial Markets



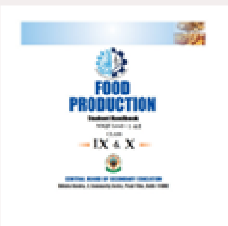
Introduction To Tourism



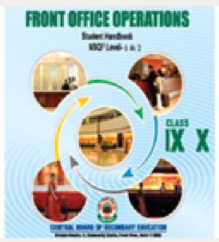
Beauty & Wellness



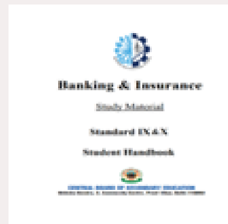
Agriculture



Food Production

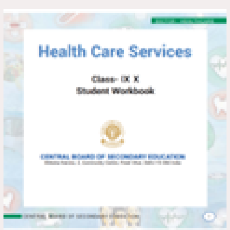


Front Office Operations



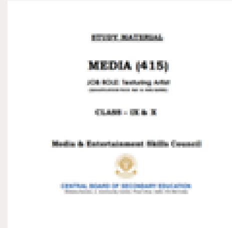
Banking & Insurance

Marketing & Sales

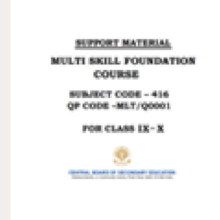


Health Care

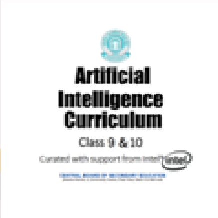
Apparel



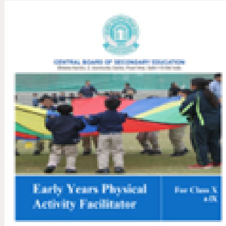
Multi Media



Multi Skill Foundation Course



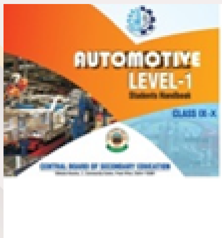
Artificial Intelligence



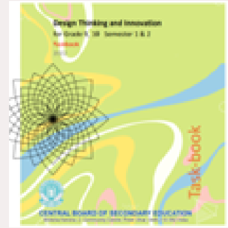
Physical Activity Trainer

Data Science

Electronics & Hardware (NEW)

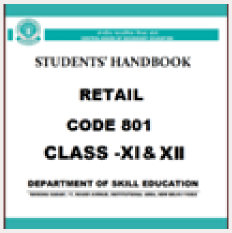


Foundation Skills For Sciences (Pharmaceutical & Biotechnology)(NEW)

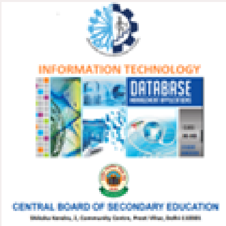


Design Thinking & Innovation (NEW)

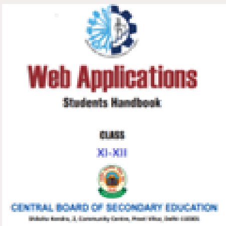
SKILL SUBJECTS AT SR. SEC. LEVEL (CLASSES XI – XII)



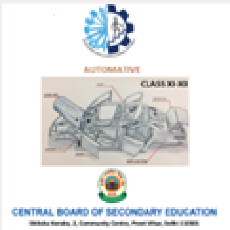
Retail



InformationTechnology

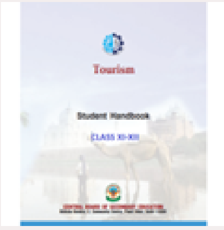


Web Application

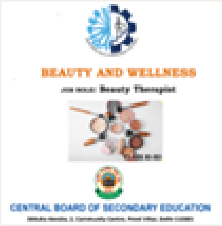


Automotive

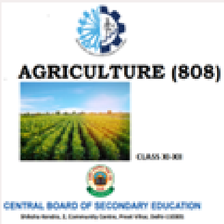
Financial Markets Management



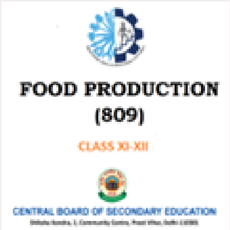
Tourism



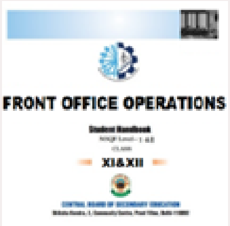
Beauty & Wellness



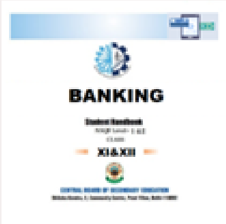
Agriculture



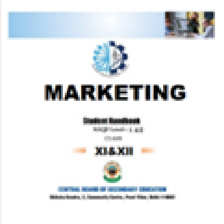
Food Production



Front Office Operations



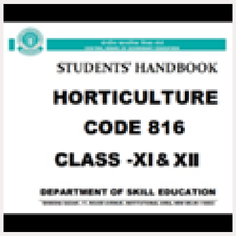
Banking



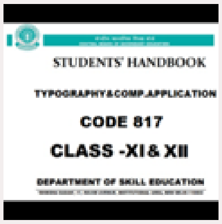
Marketing

Health Care

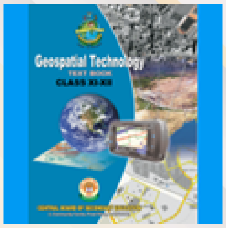
Insurance



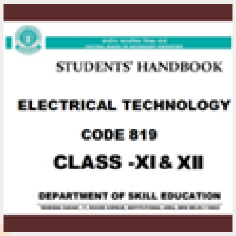
Horticulture



Typography & Comp. Application

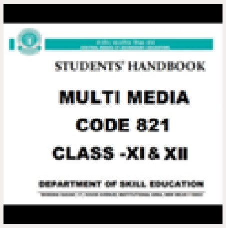


Geospatial Technology

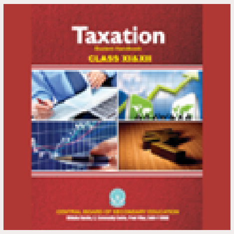


Electrical Technology

Electronic Technology

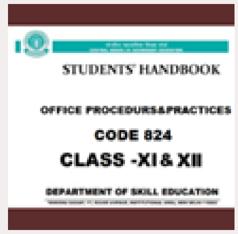


Multi-Media

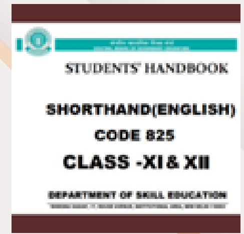


Taxation

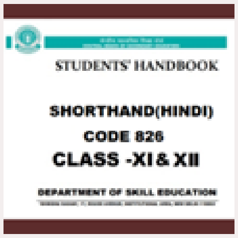
Cost Accounting



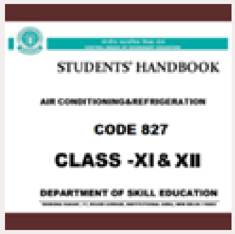
Office Procedures & Practices



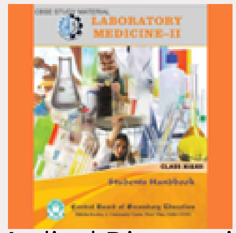
Shorthand (English)



Shorthand (Hindi)

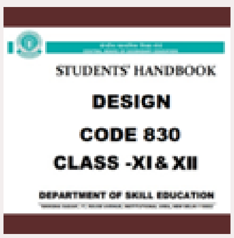


Air-Conditioning & Refrigeration

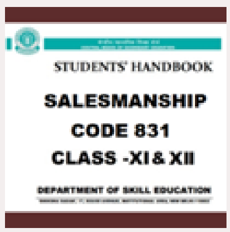


Medical Diagnostics

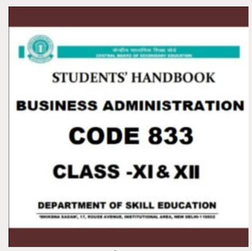
Textile Design



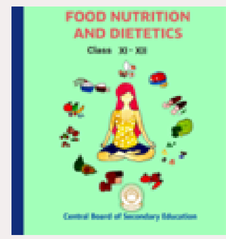
Design



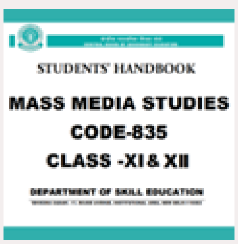
Salesmanship



Business Administration

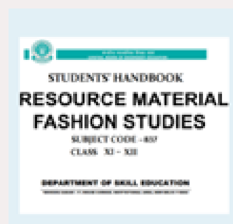


Food Nutrition & Dietetics

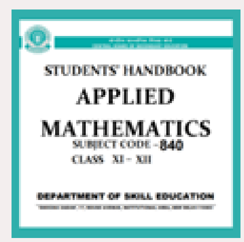


Mass Media Studies

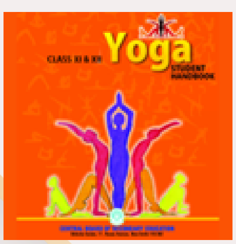
Library & Information Science



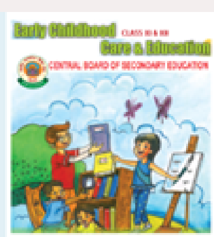
Fashion Studies



Applied Mathematics



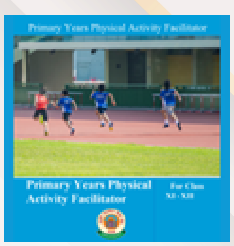
Yoga



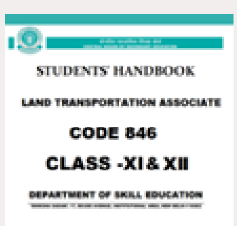
Early Childhood Care & Education

Artificial Intelligence

Data Science



Physical Activity Trainer(new)



Land Transportation Associate (NEW)

Electronics & Hardware (NEW)

Design Thinking & Innovation (NEW)